TAB 13C - SITE 19SAP

PC/DW #3

EXHIBIT
6
PENGAD-Bayonne, N. J.
5-30-97
J.H.S.H

EXHIBIT
10
PENGAD-Bayonne, N. J.
5-30-97
P. EDQUIST

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THE AWARE CORPORATION

consultants in environmental management

ELF000089

# HYDROGEOLOGIC AND ENGINEERING EVALUATIONS OF WASTE MANAGEMENT FACILITIES

Conducted For:

PENNWALT CORPORATION
Tacoma, Washington
King of Prussia, Pennsylvania

Prepared By:

AWARE, Inc.
P.O. Box 40284
Nashville, Tennessee 37204

November 1981

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# SECTION 1

# EXECUTIVE SUMMARY

## 1.1 PROJECT OBJECTIVES

The engineering project reported herein was conducted by AWARE, Inc. of Nashville, Tennessee for the Pennwalt chemical facility in Tacoma, Washington. The Pennwalt Corporation in King of Prussia, Pennsylvania, authorized the studies as part of an overall "Hydrogeologic and Engineering Evaluations" at the site. Field investigations were conducted during the period from March through September, 1981.

The primary objectives of this project were:

1. Evaluate the waste management facilities at the plant to determine whether or not they are hazardous waste facilities according to the U.S. EPA, RCRA criteria;
2. Evaluate active and inactive treatment/disposal areas;
3. Investigate and evaluate contaminant migration at the facility;
4. Determine future operation and closure requirements of active and inactive waste management facilities.

## 1.2 SCOPE OF WORK CONDUCTED

Comprehensive groundwater, soil, and surface runoff investigative/sampling programs were implemented to establish the existing environmental conditions and the potential movement of contaminants from the plant site. These programs include the following:

1. A total of 30 groundwater monitoring wells were installed at the facility with ten wells tapping a deep water-bearing zone present at a depth of about 45 ft, 11 wells tapping an intermediate water-bearing zone present at a depth of about 15-20 ft, and nine wells tapping a shallow surficial water-bearing zone.
2. A total of four rounds of samples were collected from these 30 monitoring wells with the following analyses being performed.
   i. Round 1 - priority pollutants and list of limited parameters for 21 initial wells.
   ii. Round 2 - list of limited parameters for initial 21 wells.
   iii. Round 3 - reduced list of parameters for five shallow zone wells.
   iv. Round 4 - arsenic for seven shallow zone wells.
3. Soil samples were collected at five-ft intervals in each of the deep wells and in test borings P-B1, P-B2, and P-B3 in order to determine the physical characteristics of the underlying materials as well as the leachability of entrained contaminants.
4. Four supplemental test borings were installed at the Ag Chem site with 11 supplemental test borings drilled at the Penite site. These borings were installed in order to more accurately define the locations of past waste disposal sites in these areas.
5. Grab samples of surface runoff and surface discharges from three sewer lines were collected. EP Toxicity tests and limited parameter analyses were performed on these samples.

6. Grab samples were collected from the visual seepage zones along the Hylebos Waterway with EP Toxicity tests and limited parameter analyses being performed.
7. Sludge and supernatant samples were collected from the existing waste management sites as well as the two inactive sites.
8. Individual samples from each waste area were composited and subjected to EP toxicity and corrosivity (pH) analyses.

## 1.3 PROJECT FINDINGS

The following summarizes the major findings of the hydrogeologic and seepage evaluation conducted at the Pennwalt facility.

1. Three separate water-bearing units were identified at the Pennwalt facility which included:
   a. Shallow surficial zone extending to an average depth of about 10 ft comprised of hydraulically filled material consisting of fine-to-coarse-grained silty sand.
   b. Intermediate zone at a depth of about 15-20 ft comprised of fine-to-coarse-grained sand.
   c. Deep zone at a depth of about 45 ft comprised of fine-to-coarse-grained sand.
2. Groundwater movement in each of the three water-bearing zones is basically to the north (to the Hylebos Waterway). The intermediate and deep water-bearing zones are tidally influenced, whereas the shallow zone showed no response to tidal changes.
3. The results of the soil sampling program indicated that minimal concentrations of contaminants are entrained in the unsaturated

zone between the ground surface and the top of the uppermost water table. Therefore, little potential exists for subsequent release of contaminants to the groundwater system.

4. The four pathways for possible contaminant migration to the Hylebos Waterway identified during this investigation were:
   a. groundwater.
   b. visual seeps along the waterway.
   c. three sewer lines.
   d. surface runoff.
5. The results of the groundwater monitoring program showed that an impact to the groundwater has occurred as a result of operations in the Taylor Lake area and the inactive Penite disposal area.
6. Those contaminants consistently detected above background levels in the groundwater monitoring program included arsenic, chloroform, and chromium.
7. Cyanide was detected in most of the intermediate zone wells and the initial shallow zone wells with the highest concentrations being detected in well, P-9S.
8. The migration of contaminants through the groundwater at the Pennwalt facility was found to be essentially through the shallow, surficial zone.
9. Of the four identified contaminant transport pathways, the three sewer lines were found to be the most significant source of arsenic loading to the waterway.

10. Surface runoff and visual seeps along the waterway were found to be minor pathways for contaminant migration to the Hylebos Waterway. Furthermore, the discharges from these sources have been substantially reduced as a result of discontinuation of wastewater discharges to the Cell Room Pond.

## 1.4 CONCLUSIONS

Based upon the findings of this study, the major conclusions of the study are:

1. Considering the concentration distribution of arsenic and the prevailing hydrogeologic conditions at the site, the source of arsenic is concluded to be the inactive Penite (sodium arsenite) disposal area. The spent blasting sands (ASARCO) are not considered to be a significant source of arsenic.

2. The concentration distribution of chloroform at the Pennwalt facility indicates two probable sources. One source is the inactive chloroform disposal site. The other is thought to be the result of the reaction of free chlorine with naturally occurring organic matter. With the discontinuation of discharges to the Cell Room Pond, the formation of chloroform by this reaction will be eliminated in this area.

3. The source of chromium detected at the site was identified as the inactive Chlorate pond based upon the observed concentration distribution of chromium in groundwater samples.

4. Cyanide was detected in several monitoring wells during the course of the investigation. The concentration distribution

observed for cyanide and the prevailing hydrogeologic conditions confirm a source not on Pennwalt property which is located south/southwest of monitoring station P-9.

5. The results from the groundwater monitoring program indicate that the surficial zone has apparently contained the contaminants of concern within a relatively small area, and has prevented any significant vertical migration of contaminant into the intermediate and deep zone which represent naturally-occurring groundwater aquifers.

6. The calculated loading rates from the groundwater system to the waterway for chloroform, chromium, and arsenic are 0.24, 0.019, and 1.06 lb/day, respectively. Due to the length of time since the arsenic wastes were disposed, it is believed that the groundwater system should have reached steady-state flow conditions with the contaminant concentrations decreasing with time. Therefore, the discharge of arsenic to the waterway should continue to decrease with time except for minor seasonal fluctuations.

7. Based upon the initial seep samples collected as part of this study, the total loading of chloroform, chromium, and arsenic from the visual seeps was calculated to be approximately 0.20, 0.0025, and 0.0015 lb/day, respectively. After the discontinuation of discharges to the Cell Room Pond, there was no observable flow from the seeps, except for station NW-7. A subsequent sample was collected from NW-7, and using an estimated flow of

0.25 gal/min, the discharge of chloroform from this seep would be approximately 0.001 lb/day. Therefore, only minimal quantities of contaminants would be expected to be discharged to the waterway from the seepage zones.

8. The calculated loading rates from the three sewer lines for chromium and chloroform were 0.008 and 0.005 lb/day, respectively.

9. The calculated arsenic loading rate of 6.83 lb/day from the three sewers represents approximately 86 percent of the total arsenic discharge to the waterway from the four identified transport pathways. With the plugging of these three sewers upgradient of the Penite area, the arsenic loading from these sources will be eliminated or minimized. Surface runoff previously associated with the plugged sewer system has been diverted to the plant stormwater system.

10. The surface runoff loadings for arsenic, chloroform, and chromium were calculated to be 0.05, 0.23, and 0.01 lb/day, respectively. With the elimination of the standing water associated with the operation of the Cell Room Pond, there should be little surface runoff from this area in the future. Therefore, subsequent loadings as a result of contaminated surface runoff should essentially be eliminated.

## 1.5 RECOMMENDATIONS

Based upon the investigations and evaluations conducted as part of this study, the following recommendations are presented:

1. Discontinue operations at the Taylor Lake area and close out the site.
2. Construct new asbestos pond and brine mud pond in the Taylor Lake area.
3. Close out the Wypenn area.
4. Seal the three sewers associated with stations NW-8, NW-10, and NW-11 which have been found to discharge arsenic. These sewers should be sealed upgradient from the inactive Penite site. Surface runoff associated with these plugged sewers will be diverted to the plant stormwater system.
5. Implement a groundwater monitoring program to monitor and evaluate the anticipated decreasing trend in contaminant concentrations in the water-bearing zones beneath the facility.

REMOVE PENTITE SLUDGES ?

SECTION 2

INTRODUCTION

## 2.1 PROJECT SCOPE

The engineering project reported herein was conducted by AWARE, Inc. of Nashville, Tennessee for the Pennwalt chemical facility in Tacoma, Washington. The Pennwalt Corporation in King of Prussia, Pennsylvania, authorized the studies as part of an overall "Hydrogeologic and Engineering Evaluations" at the site. Field investigations were conducted during the period from March through September, 1981.

The primary goals of this project were:

1. Evaluate the waste management facilities at the plant to determine whether or not the wastes are hazardous according to the U.S. EPA, RCRA criteria;
2. Evaluate active and inactive treatment/disposal areas;
3. Investigate and evaluate contaminant migration at the facility; and
4. Determine future operation and closure requirements of present and past waste management facilities.

## 2.2 GENERAL SITE AND PLANT INFORMATION

### 2.2.1 Site Location

The Pennwalt plant site is located in Tacoma, Washington in the Commencement Bay industrial area as shown in Figure 2-1. The site as shown in Plate 1 (fold-out in back cover) covers approximately 45 acres and is


LOCATION MAP
CANADA
U.S.
IDAHO
WASHINGTON
OREGON
PENNWALT CORP.
SEATTLE
TACOMA
PORTLAND
PACIFIC OCEAN
PLANT NORTH
THE RWARE CORPORATION
NASHVILLE, TENNESSEE
HOUSTON, TEXAS
PENNWALT CORP.
Tacoma, Wash.
HYDROGEOLOGIC AND RCRA
ENGINEERING STUDY
FIGURE 2.1
SITE LOCATIONS
GRAPHIC SCALE
1/2
0
1/2
Miles
PENNWALT CORP.
Tyee Marina
Puget Sound
Browns Point
Browns Point
COMMENCEMENT BAY
Hylebos Waterway
Blair Waterway
Sitcum Waterway
Puyallup Waterway
St. Paul Waterway
Middle Waterway
City Waterway

bounded to the northeast by the Hylebos Waterway, a channelized waterway that is connected to Commencement Bay; and to the southwest by rail tracks and Taylor Way (the main local highway). Louisiana-Pacific's woodyards are adjacent to the south and southeast boundaries of the Pennwalt site (the Louisiana-Pacific property to the south of the site was once occupied by Ohio-Ferro Alloys). Petroleum Reclaiming is located in a small triangular area adjacent to the southeast corner of the site. L. B. Foster Warehouse is located immediately across Taylor Way from the site along Pennwalt's western boundary and U.S. Gypsum is located adjacent to the northern site boundary. The nearest residential areas to the site are located along Taylor Way about 1 road mile to the southeast. The site is served by rail, barge, and ocean-going ships and is located about 1.5 miles north from I-5.

### 2.2.2 Site History

The Commencement Bay industrial area was developed during the 1920's when the salt marsh area of Commencement Bay was filled in to allow industrial construction. Several waterways for boat and barge access were dredged into the filled-in salt marsh area. The Pennwalt facility was constructed adjacent to the Hylebos Waterway in the 1920's. The site has historically produced chlorine, caustic soda, chlorate salts, and herbicides (sodium arsenite).

### 2.2.3 Present Production

The plant presently produces chlorine, caustic, sodium chlorate, sodium hypochlorite, and hydrochloric acid. An agricultural chemical

research group of Pennwalt conducts basic research with agricultural herbicides and pesticides in the Wypenn Building on-site.

Chlorine and caustic are produced by electrolysis of a saturated brine solution with the diaphragm cell process. Chlorate salts are produced by electrolysis of an acidified saturated brine solution.

## 2.3 PRESENT SOLID WASTE GENERATION AND MANAGEMENT

The following paragraphs give descriptions of solid waste generated in each site production process.

### 2.3.1 Chlorine-Caustic Production

Three different waste materials are produced during chlor-caustic production:

1. Brine muds - an estimated 1,500-2,000 lb/day of brine muds consisting of about 1,400 lb/day calcium carbonate ($CaCO_3$) and about 510 lb/day magnesium hydroxide ($Mg(OH)_2$) are produced. Brine muds are presently slurried from the brine saturator tanks (10 percent solids) to the Cell Room Pond waste disposal area approximately once every six months. An Enviro-Clear Thickener is being installed at the plant and estimated total brine mud production from this process is about 75 lb/day.
2. Asbestos - an estimated 25,000 to 30,000 gal of process wastewaters containing approximately 1,375 lb of solids (primarily spent asbestos) are sent to the Asbestos Lagoons in batches about once per month.

ISN'T THIS GOING OUT THE OUTFALL NOW

3. Residual chlorine - process wastewaters from the cell room containing hypochlorite are sent to either Waggoners Wallow (7,000 gal/wk maximum) or the Cell Room Pond (40,000 gpd maximum). The discharge to the Cell Room Pond was discontinued since early October, 1981.

2.3.2 Chlorate Production

The chlorate process is basically a closed loop (zero discharge) where wastewater is collected, filtered, and recycled back in the process.

+ sludge (Lime)

SECTION 3

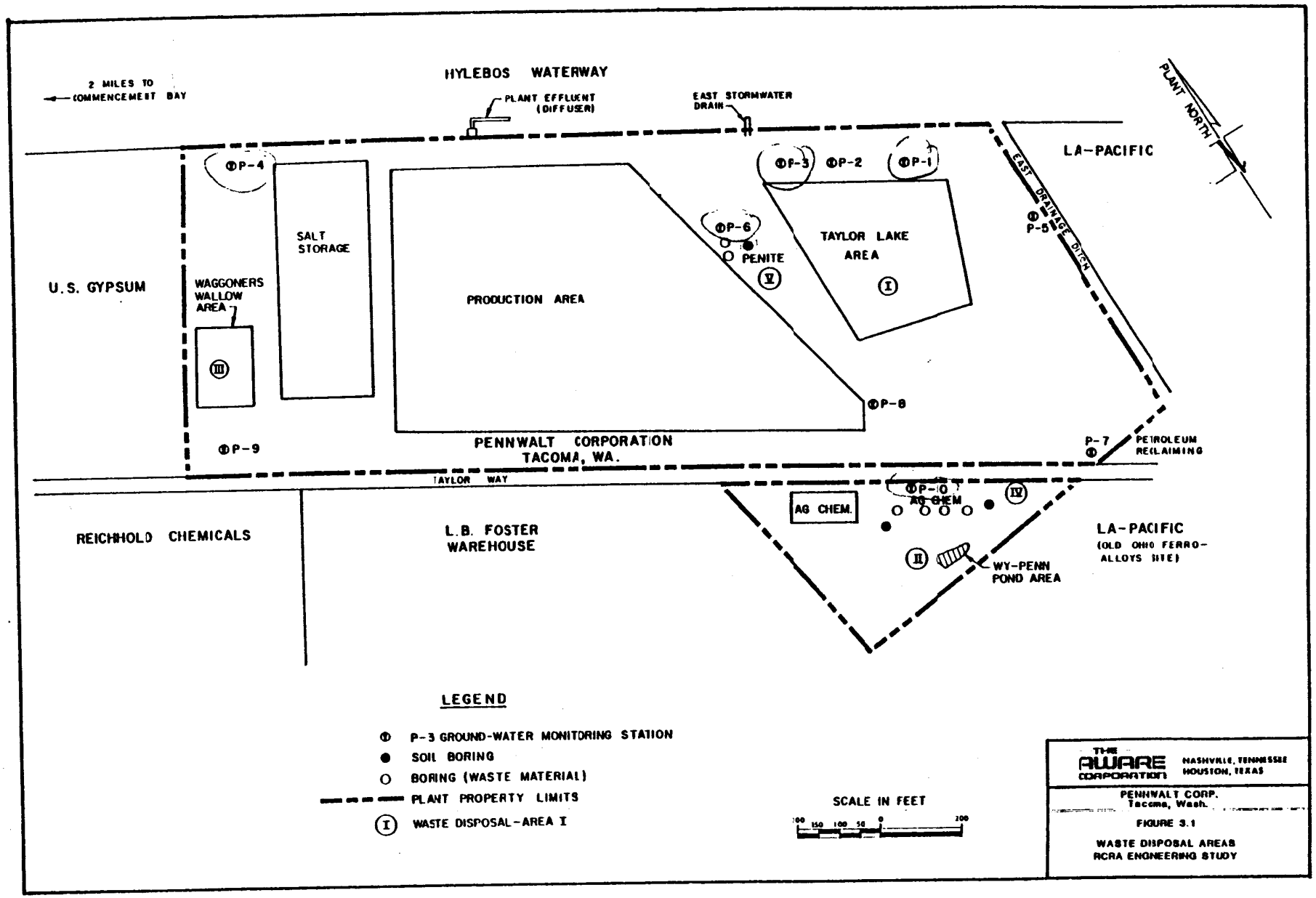
# WASTE CHARACTERIZATION

## 3.1 INTRODUCTION

A solid waste inventory and characterization study at the Pennwalt-Tacoma site was conducted by AWARE personnel during March and April, 1981. Three active and two past waste-disposal areas were included in the study as follows:

1. Taylor Lake Area - active; disposal lagoons for brine muds, asbestos, and chlorine condensate. (Area I in Figure 3-1)
2. Wypenn Pond - active; disposal lagoon for waste oils and past Ag Chem lab wastes. (Area II in Figure 3-1)
3. Waggoners Wallow - active; disposal lagoon for waste sodium hypochlorite (liquid). (Area III in Figure 3-1)
4. Ag Chem and Penite sites - inactive; Ag Chem site, pits received solid and liquid laboratory wastes from research lab (Area IV in Figure 3-1); Penite site, pits and lagoon received solid and liquid wastes from previous herbicide production. (Area V in Figure 3-1)

AWARE established a data collection and sampling program to obtain physical descriptions of these disposal areas and physical-chemical characterizations of the associated wastes. Locations of the waste facilities and sampling points are shown in Figure 3-1.


2 MILES TO COMMENCEMENT BAY
HYLEBOS WATERWAY
PLANT EFFLUENT (DIFFUSER)
EAST STORMWATER DRAIN
PLANT NORTH
LA-PACIFIC
P-4
P-3
P-2
P-1
P-5
EAST DRAINAGE DITCH
SALT STORAGE
P-6
PENITE
TAYLOR LAKE AREA
U.S. GYPSUM
WAGGONERS WALLOW AREA
PRODUCTION AREA
P-8
P-9
PENNWALT CORPORATION
TACOMA, WA.
P-7
PETROLEUM RECLAIMING
TAYLOR WAY
AG CHEM.
P-10
AG CHEM
REICHHOLD CHEMICALS
L.B. FOSTER WAREHOUSE
LA-PACIFIC
(OLD OHIO FERRO-ALLOYS SITE)
WY-PENN POND AREA
LEGEND
P-3 GROUND-WATER MONITORING STATION
SOIL BORING
BORING (WASTE MATERIAL)
PLANT PROPERTY LIMITS
WASTE DISPOSAL-AREA I
SCALE IN FEET
THE AWARE CORPORATION
NASHVILLE, TENNESSEE
HOUSTON, TEXAS
PENNWALT CORP.
Tacoma, Wash.
FIGURE 3.1
WASTE DISPOSAL AREAS
RCRA ENGINEERING STUDY

## 3.2 FIELD SAMPLING METHODOLOGY

The sampling program generally followed recommended U.S. EPA procedures as outlined in the following publications:

1. Testing Methods for Evaluating Solid Wastes
2. Methods for Chemical Analyses of Water and Wastes
3. Standard Methods

### 3.2.1 Active Lagoon Areas

Individual sludge and liquid samples were collected from the Taylor Lake, Wypenn Pond, and Waggoners Wallow areas. A 5-ft PVC pipe with a 3-inch inner diameter was forced by hand into the lagoon sludges, a semi-vacuum applied, and the sludge sample removed and placed into an appropriate container. Grab liquid samples from the lagoons were collected by placing the appropriate sample jar about 6 to 12 inches beneath the surface. All samples were taken to the on-site lab and the following analyses were performed:

DEPTH OF SAMPLE = 5 ft.

Sludge Samples: Individual grab samples from a lagoon and a composite sample comprised of each of the individual samples in that lagoon were analyzed for pH, conductivity, moisture content, and density.

Water Samples: Individual grab and composite samples were analyzed for pH, conductivity, free and total residue chlorine.

Composite sludge and liquid samples from each lagoon were taken to Laucks Laboratory in Seattle for further chemical analyses.

Lagoon sludge and liquid depths were measured using a calibrated rod. Lagoon dimensions were measured using a 100 ft steel engineering tape. Flows from pipes in drainage ways or from visual seeps were determined

using a bucket and stopwatch or by estimate (velocity x depth x width). Elevations were shot from a reference on-site bench mark (BM) located in the doorway of the hydrochloric acid (HCl) production area (BM Elevation 23.0 ft MSL). A surveyors transit was used to shoot the elevations.

### 3.2.2 Inactive Sites

Environmental Emergency Services of Portland, Oregon was contracted to obtain soil samples from both the Ag Chem and Penite disposal sites. Borings were made into the Penite site at two locations and at the Ag Chem site at four locations. Split-spoon samples were collected at 5-ft intervals through a total boring depth of about 15 ft. The split-spoon samples were taken to Laucks Lab in Seattle for soil leaching tests using a modified EP Toxicity technique. An additional nine test borings were drilled at the Penite site in an attempt to more accurately define waste disposal sites. The results of these boring programs are discussed in Section 4.

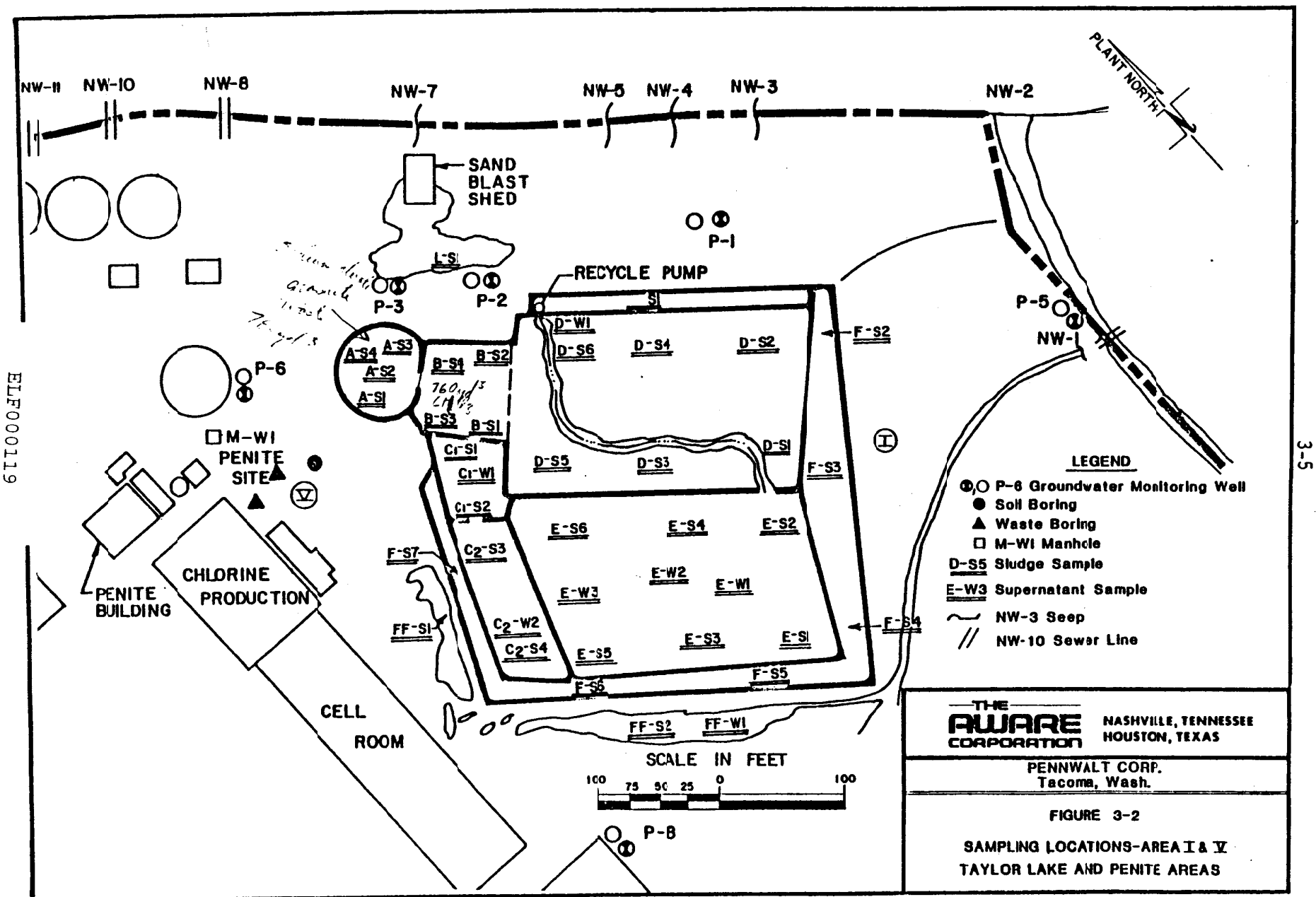
## 3.3 WASTE DISPOSAL AREA CHARACTERIZATION

Each of the four identified disposal areas is discussed separately in the following sections.

### 3.3.1 Taylor Lake Area

The Taylor Lake Waste Treatment and Disposal Area encompasses a total surface area of about 2.73 acres. As shown in Figure 3-2, this area is made up of five small ponds, two drainage moats, and one waste pile as follows:

1. Chlorate Pond - inactive since summer, 1979; dichromate. (A Pond in Figure 3-2)


NW-11
NW-10
NW-8
NW-7
NW-5
NW-4
NW-3
NW-2
PLANT NORTH
SAND BLAST SHED
P-1
P-2
P-3
P-5
P-6
NW-1
RECYCLE PUMP
L-S1
S1
D-W1
D-S6
D-S4
D-S2
F-S2
A-S4
A-S3
A-S2
A-S1
B-S4
B-S2
B-S3
B-S1
760 yd3
D-S1
D-S5
D-S3
F-S3
Cr-S1
Cr-W1
Cr-S2
E-S6
E-S4
E-S2
F-S7
C2-S3
E-W2
E-W3
E-W1
FF-S1
C2-W2
C2-S4
E-S5
E-S3
E-S1
F-S4
F-S5
F-S6
FF-S2
FF-W1
M-W1
PENITE SITE
PENITE BUILDING
CHLORINE PRODUCTION
CELL ROOM
P-8
SCALE IN FEET
100 75 50 25 0 100
LEGEND
P-6 Groundwater Monitoring Well
Soil Boring
Waste Boring
M-W1 Manhole
D-S5 Sludge Sample
E-W3 Supernatant Sample
NW-3 Seep
NW-10 Sewer Line
THE AWARE CORPORATION
NASHVILLE, TENNESSEE
HOUSTON, TEXAS
PENNWALT CORP.
Tacoma, Wash.
FIGURE 3-2
SAMPLING LOCATIONS-AREA I & V
TAYLOR LAKE AND PENITE AREAS

ELF00119

2. West Taylor Lake Extension - inactive since December 1975; chlorine impurities containing chloroform. (B Pond)
3. Asbestos Pond - active; asbestos. (C Pond)
4. Taylor Lake - inactive; brine muds consisting of $CaCO_3$ and $Mg(OH)_2$. (D Pond)
5. Cell Room Pond - active; chlorine condensate and brine muds. (E Pond)
6. Recycle Moat - active; leachate recycle from lagoons. (F Pond)
7. Storm Runoff Moat - active; area leachate and storm runoff. (FF Pond)
8. Sand-Blasting Shed - active; spent blasting sands waste pile. (L Pond)

All sampling locations in the Taylor Lake Area have been shown in Figure 3-2.

3.3.1.1 Chlorate Pond. The Chlorate Pond is circular in appearance with a diameter of about 75 ft and covers about 0.1 surface acres. This pond has been inactive since the summer of 1979 and presently contains only solid waste. The eastern side of the pond dike is open to Taylor Lake.

Cl-org - in Graphite? Historically, the pond received from 1967 through the mid-1970's both brine sludge and graphite waste. After a temporary deactivation, the pond was used again from 1978 to summer 1979 for waste sodium chlorate and some dichromate (corrosion inhibitor) until a wastewater recycling system for the chlorate process was put into operation. The pond has not been used since summer 1979. The primary waste product of concern disposed of in this pond is the dichromate (hexavalent chrome).

The pond is encircled by a small dike with top elevations ranging from 24.0 to 26.9 ft MSL (ground surface around the Taylor Lake area is at about

Elevation 21-22 ft MSL). The sludge surface is at about Elevation 23.9 ft MSL. Total depth of sludge is about 5 ft and the pond presently contains about 780 cu yd of solid waste.

Four vertical sludge column samples were obtained from this pond. Analytical results from each of the four individual vertical samples and from a composite sample made up from the four vertical samples are presented in Tables 3-1 and 3-2. The sludge was alkaline; high in salt content; relatively moist; and had a density similar to soil. The sludge supported a man's weight. From Table 3-2, the sludge in the Chlorate Pond is nonhazardous according to current U.S. EPA definitions.

3.3.1.2 West Taylor Lake Extension. The West Taylor Lake Extension is a small extension of the larger Taylor Lake. There is no dike between the two impoundments. The pond is square in appearance and covers about 0.1 surface acres. This pond has been inactive since December 1975 except for containment of brine muds from the larger Taylor Lake.

Historically, the pond received about 75,000-100,000 lb of chlorine impurities containing chloroform during 1974 and 1975. This practice was discontinued in December 1975. The graphite anode contained linseed oil and the chlorine produced at the anode reacted with the linseed oil as follows:

NEEDS A REAL CLOSE LOOK

$$\text{Linseed Oil (hydrocarbon)} + Cl_2 \longrightarrow CHCl_3 \text{ (Chloroform)}$$

The dike around three sides of the West Taylor Lake Extension (open to Taylor Lake on one side) has a minimum elevation of 26.1 ft MSL and the top of the sludge in the pond is at about 24.6 ft MSL. There is no standing

TABLE 3-1

HAZARDOUS WASTE ANALYSES
CHLORATE POND (INACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.95 | [a] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | <0.01 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | 2.1 | | 5.0 |
| Pb | <0.1 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | 0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | 2.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | <0.008 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]No standing water in pond.

TABLE 3-2

WASTE CHARACTERIZATION - CHLORATE POND

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.1 acres
Dike Minimum Elevation : 23.9 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 23.8 ft msl | None |
| Depth | 4.8 ft | 0 |
| Volume: | 780 cu yds | 0 |

Status: Inactive

| Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-A-S1 | 11.65 | 50,000 | 48 | 94 |
| PT-A-S2 | 12.25 | 153,000 | 42 | 106 |
| PT-A-S3 | 12.05 | 70,000 | 48 | 100 |
| PT-A-S4 | 11.65 | 46,000 | 47 | 100 |
| PT-A-Composite | 11.95 | 76,000 | 46 | 100 |

water in this pond. Total depth of sludge is about 5 ft and total sludge volume is about 760 cu yd.

Four vertical column sludge samples were obtained from this pond and analytical results for these samples and a composite sample made up from the four individual samples are given in Tables 3-3 and 3-4. The sludge was alkaline in pH, had a salt content slightly higher than seawater, and was relatively moist. From Table 3-4, the sludge in the West Taylor Lake Extension is a nonhazardous waste according to EPA definition.

3.3.1.3 Asbestos Pond. The Asbestos Pond consists of two cells that combined have a total surface area of about 0.29 acres. Currently, wash waters containing particulate asbestos from the electrolyzers in the diaphragm cells (chlorine-caustic production) are intermittently discharged to Cell 1 of the Asbestos Pond. This cell occupies approximately 0.09 surface acres. This cell is at capacity and washwaters flow straight through it and into Cell 2. Cell 1 can be classified as inactive (no contribution to waste management). Cell 2 occupies about 0.16 surface acres and this area is the settling basin for solids in the effluent stream entering through Cell 1.

The Asbestos Pond (through Cell 1) receives about 25,000 to 30,000 gal of wash waters containing about 1,375 lb/month of solids containing asbestos. These waters are discharged to the pond in batches about once per month which yields 220 cu ft or 8.1 cu yd of solid wastes per year.

TABLE 3-3

WASTE CHARACTERIZATION - WEST TAYLOR LAKE EXTENSION

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.10 acres
Dike Minimum Elevation : 26.0 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 24.5 ft msl | (None) |
| Depth: | 4.8 ft | 0 |
| Volume: | 760 cu yds | 0 |

Status: Inactive

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-B-S1 | 11.55 | 54,000 | 50 | 94 |
| PT-B-S2 | 11.65 | 62,000 | 48 | 100 |
| PT-B-S3 | 11.95 | 82,000 | 51 | 100 |
| PT-B-S4 | 11.80 | 50,000 | 49 | 94 |
| PT-B-Composite | 11.75 | 68,000 | 49 | 100 |

TABLE 3-4

HAZARDOUS WASTE ANALYSES
WEST TAYLOR LAKE EXTENSION (INACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.75 | [a] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | < 0.01 | | 5.0 |
| Ba | < 0.5 | | 100.0 |
| Cd | < 0.02 | | 1.0 |
| Cr | 0.7 | | 5.0 |
| Pb | 0.1 | | 5.0 |
| Hg | < 0.005 | | 0.2 |
| Se | < 0.01 | | 1.0 |
| Ag | < 0.1 | | 5.0 |
| Cr(hex) | 0.7 | | |
| Endrin | < 0.0008 | | 0.02 |
| Lindane | < 0.004 | | 0.4 |
| Methoxychlor | < 0.010 | | 10.0 |
| Toxaphene | < 0.010 | | 0.5 |
| 2,4-D | < 0.008 | | 10.0 |
| 2,4,5-TP Silvex | < 0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]No standing water in pond.

The dike around the Asbestos Pond has a minimum elevation of about 26.1 ft MSL and the top of the sludge in Cell 1 is about Elevation 23 ft MSL and in Cell 2 is about Elevation 21.7 ft MSL. Total sludge depths and volumes are about 3 ft and 420 cu yd in Cell 1 and 2 ft and 520 cu yd in Cell 2. There is no supernatant ( 0.1 ft) in Cell 1. Cell 2 supernatant was about 1.2 ft deep and at this depth the cell contained about 0.065 MG.

Four vertical sludge samples and two grab supernatant samples were obtained from the Asbestos Pond. Analytical results for the individual sludge samples, for a composite sludge sample and a supernatant composite sample are presented in Tables 3-5 and 3-6. The sludges in the Asbestos Pond are classified as nonhazardous wastes and the supernatant in the Pond is also classified as a nonhazardous waste according to U.S. EPA definition.

3.3.1.4 Taylor Lake. Historically, brine muds from the Brine Settling Tanks have been slurried (10 percent solids) over a one-day period approximately once every six months to Taylor Lake. Typically about 365 tons/yr of brine sludges were disposed in the pond. These sludges consisted primarily of calcium carbonate ($CaCO_3$) and magnesium hydroxide ($Mg(OH)_2$).

TABLE 3-5

WASTE CHARACTERIZATION - ASBESTOS POND

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.29 acres
Dike Minimum Elevation : 26.0 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | (C1) 22.9 ft msl | (None) |
| | (C2) 21.7 ft msl | 22.9 ft msl |
| Depth: | (C1) 3.0 ft | <0.1 ft |
| | (C2) 2.0 ft | 1.2 ft |
| Volume: | (C1) 420 cu yds | 1,500 gal |
| | (C2) 520 cu yds | 65,000 gal |

Status: Active

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-C-S1 | 10.75 | 14,000 | 86 | 69 |
| PT-C-S2 | 11.70 | 17,000 | 63 | 81 |
| PT-C-S3 | 6.70 | 4,700 | 78 | 75 |
| PT-C-S4 | 7.00 | 5,000 | 66 | 75 |
| PT-C-Composite | 9.45 | 6,500 | 74 | 75 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine | |
|---|---|---|---|---|
| | | | Free (mg/l) | Total (mg/l) |
| PT-C-WC | 5.30 | 2,200 | 80 | 80 |

TABLE 3-6

HAZARDOUS WASTE ANALYSES
ASBESTOS POND (ACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 9.45 | 5.30 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.04 | 0.16 | 5.0 |
| Ba | <0.5 | <0.1 | 100.0 |
| Cd | <0.02 | <0.002 | 1.0 |
| Cr | <0.1 | 0.080 | 5.0 |
| Pb | <0.1 | 0.010 | 5.0 |
| Hg | <0.005 | 0.002 | 0.2 |
| Se | <0.01 | <0.01 | 1.0 |
| Ag | <0.1 | <0.002 | 5.0 |
| Cr(hex) | <0.1 | 0.050 | |
| Endrin | <0.0008 | -- | 0.02 |
| Lindane | <0.004 | -- | 0.4 |
| Methoxychlor | <0.010 | -- | 10.0 |
| Toxaphene | <0.010 | -- | 0.5 |
| 2,4-D | <0.008 | -- | 10.0 |
| 2,4,5-TP Silvex | <0.008 | -- | 1.0 |
| Classification | non-hazardous | non-hazardous | |

During the data collection phase of this study, the Taylor Lake Dike was open to the Cell Room Pond, the West Taylor Lake Extension, and the Chlorate Pond; however, it is currently closed to the Cell Room Pond. Minimum dike crest elevation is about 25 ft MSL and the sludge surface elevation is at about 23.9 ft MSL. Total depth of sludge is about 5 ft. There was no standing water in Taylor Lake during the field survey period.

Six vertical sludge samples, an influent brine slurry sample from the Brine Settling Tanks, and one liquid sample (at the recirculation discharge into the pond from the Taylor Lake Moat) were obtained for analysis. Analytical results for the individual sludge and liquid samples and for a composite sludge sample made up from the six individual sludge samples are presented in Tables 3-7 and 3-8. The sludge was alkaline, had a high salt content; and was relatively moist. The sludge supported a man's weight (some settlement). From Table 3-8, the sludge in Taylor Lake is classified as a nonhazardous waste according to EPA's standards for EP Toxicity.

The leachate recycle from Taylor Lake Moat passing through Taylor Lake was found to be acidic in pH; brackish in conductivity (note: brackish waters have conductivities ranging from about 1,000 to 28,000 micromhos/cm, whereas sea water has a conductivity of around 52,000 micromhos/cm), and had a total residual chlorine concentration of 700 mg/l (about 43 percent of the Cell Room Pond concentration). From Table 3-8, the leachate recycle (supernatant) passing through Taylor Lake is classified as a nonhazardous waste according to EPA's standards for EP Toxicity.

HIGH Cl SOURCE

TABLE 3-7

WASTE CHARACTERIZATION - TAYLOR LAKE

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.82 acres
Dike Minimum Elevation : 24.9 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 23.8 ft msl | (None) |
| Depth: | 4.5 ft | 0 |
| Volume: | 5,600 cu yds | 0 |
| Status: Inactive | | |

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-D-S1 | 10.20 | 18,000 | 52 | 94 |
| PT-D-S2 | 12.15 | 98,000 | 53 | 100 |
| PT-D-S3 | 12.00 | 50,000 | 52 | 94 |
| PT-D-S4 | 11.90 | 48,000 | 50 | 94 |
| PT-D-S5 | 12.30 | 150,000 | 49 | 94 |
| PT-D-S6 | 11.65 | 28,000 | 51 | 94 |
| PT-D-Composite | 11.80 | 64,000 | 52 | 94 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine Free (mg/l) | Residual Chlorine Total (mg/l) |
|---|---|---|---|---|
| PT-D-WC | 4.80 | 11,000 | 620 | 700 |

NOTE
~ 90% Free Chlorine

TABLE 3-8

HAZARDOUS WASTE ANALYSES
TAYLOR LAKE (ACTIVE)*
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.80 | 4.80 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.03 | 0.01 | 5.0 |
| Ba | 0.8 | < 0.1 | 100.0 |
| Cd | <0.02 | < 0.002 | 1.0 |
| Cr | < 0.1 | 0.48 | 5.0 |
| Pb | 0.2 | < 0.005 | 5.0 |
| Hg | <0.005 | < 0.002 | 0.2 |
| Se | <0.01 | < 0.01 | 1.0 |
| Ag | <0.1 | < 0.002 | 5.0 |
| Cr(hex) | <0.1 | < 0.01 | |
| Endrin | <0.0008 | <0.00002 | 0.02 |
| Lindane | <0.004 | <0.0004 | 0.4 |
| Methoxychlor | <0.010 | 0.005 | 10.0 |
| Toxaphene | <0.010 | < 0.001 | 0.5 |
| 2,4-D | <0.008 | < 0.008 | 10.0 |
| 2,4,5-TP Silvex | <0.008 | < 0.008 | 1.0 |
| Classification | non-hazardous | non-hazardous | |

*Currently inactive.

The influent brine slurry sample was subjected to EP Toxicity testing and results are given in Table 3-9. The raw slurry sample, gravity drained supernatant and solid samples are all classified as non-hazardous wastes according to EPA standards for EP Toxicity leachates.

3.3.1.5 Cell Room Pond. The Cell Room Pond was constructed prior to 1974, and since about 1975 the pond has received discharges from the Glanor Cell Room (chlor-caustic production). The pond is rectangular in shape and has a total surface area of about 0.83 acres.

About 30,000 to 40,000 gpd of wastewaters from the area drain and chlorine condensate from the Glanor Cell Room are discharged to the Cell Room Pond. The primary function of the pond is dissipation of residual chlorine in these wastewaters. In the past, the pond has also received overflow brine mud slurry from Taylor Lake.

During the initial survey, the pond dike had a small opening to Taylor Lake that allowed leachate from the Taylor Lake Moat to be recycled back into the Cell Room Pond. Otherwise, the minimum dike elevation is at 24.7 ft MSL. The water level in the pond was at about 22.9 ft MSL on the day of the survey, and the water depth was about 1.7 ft. The top of the sludge is at about elevation 21.2 ft MSL, and total sludge depth is about 4.0 ft.

Six vertical sludge samples and a composite grab liquid sample were obtained from this pond. Analytical results from each of the six vertical samples, a composite sample made from these individual samples, and the composite liquid sample are presented in Tables 3-10 and 3-11. The sludge samples were alkaline in pH, high in salt content, had a high moisture

TABLE 3-9

BRINE MUDS - EP TOXICITY*

| Parameter | Raw Brine Mud | Gravity Drained Solids | Gravity Drained Supernatant | U.S. EPA Hazardous Listing |
|---|---|---|---|---|
| pH | 11.3 | 11.3 | 11.3 | 12.5 >pH > 2.0 |
| Moisture Content (%) | 64 | 57 | -- | -- |
| Density (lb/cu ft) | 81 | 87 | -- | -- |
| EP Toxicity (mg/l) | | | | |
| As | <0.03 | <0.03 | <0.03 | 5.0 |
| Ba | <1 | <1 | <1 | 100.0 |
| Cd | <0.02 | <0.02 | <0.02 | 1.0 |
| Cr | <0.05 | <0.05 | <0.05 | 5.0 |
| Pb | 0.33 | 0.27 | <0.20 | 5.0 |
| Hg | 0.005 | 0.007 | <0.02 | 0.2 |
| Se | <0.05 | <0.05 | <0.05 | 1.0 |
| Ag | <0.05 | <0.05 | <0.05 | 5.0 |
| Waste Listing: | Non-Hazardous | Non-Hazardous | Non-Hazardous | |

*by AWARE Laboratory, Nashville, Tennessee.

TABLE 3-10

WASTE CHARACTERIZATION - CELL ROOM POND

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.83 acres
Dike Minimum Elevation : 24.6 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 21.1 ft msl | 22.8 ft msl |
| Depth: | 4.0 ft | 1.7 ft |
| Volume: | 5,200 cu yds | 438,000 gal |

Status: Active (Chlorine condensate and intermittently brine muds)

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-E-S1 | 12.65 | 144,000 | 77 | 81 |
| PT-E-S2 | 12.65 | 230,000 | 78 | 69 |
| PT-E-S3 | 12.25 | 84,000 | 78 | 69 |
| PT-E-S4 | 12.30 | 66,000 | 81 | 75 |
| PT-E-S5 | 12.30 | 84,000 | 75 | 69 |
| PT-E-S6 | 11.90 | 54,000 | 84 | 75 |
| PT-E-Composite | 12.30 | 84,000 | 81 | 75 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine Free (mg/l) | Residual Chlorine Total (mg/l) |
|---|---|---|---|---|
| PT-E-WC | 4.40 | 10,000 | 1,620 | 1,620 |

TABLE 3-11

HAZARDOUS WASTE ANALYSES
CELL ROOM POND (ACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 12.30 | 4.40 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | <0.01 | 0.45 | 5.0 |
| Ba | <0.5 | <0.1 | 100.0 |
| Cd | <0.02 | <0.002 | 1.0 |
| Cr | 0.1 | 0.47 | 5.0 |
| Pb | 0.1 | <0.005 | 5.0 |
| Hg | <0.005 | 0.018 | 0.2 |
| Se | <0.01 | <0.01 | 1.0 |
| Ag | 0.3 | <0.002 | 5.0 |
| Cr(hex) | <0.1 | <0.01 | |
| Endrin | <0.0008 | <0.00002 | 0.02 |
| Lindane | <0.004 | <0.0004 | 0.4 |
| Methoxychlor | <0.10 | <0.005 | 10.0 |
| Toxaphene | <0.10 | <0.005 | 0.5 |
| 2,4-D | <0.008 | <0.008 | 10.0 |
| 2,4,5-TP Silvex | <0.008 | <0.008 | 1.0 |
| Classification | non-hazardous | non-hazardous | |

TREND
ALKALINE SLUDGES
AND ACIDIC
SUPERNATANT.

content, and had a density only slightly greater than that of water. The sludges would not hold a man's weight. From Table 3-11, the sludges are classified as nonhazardous wastes according to EPA's EP Toxicity standards.

The composite supernatant sample (Table 3-11) was acidic in pH, brackish, and had a total residual chlorine concentration of 1,620 mg/l. The waters in the pond are classified as nonhazardous wastes according to EPA's EP Toxicity standards.

3.3.1.6 Taylor Lake Moat. A leachate collection moat encircles all but the northwest corner of the ponds in the Taylor Lake area. The moat has a surface area of about 0.27 acres and a larger ponded area exists off the eastern sides of Taylor Lake and the Cell Room Pond.

The outside dike (opposite the pond's dikes) of the moat has a top elevation of about 24.2 ft MSL. The liquid surface elevation in the moat ranged from 22.3 (next to southwest corner of Asbestos Pond) to 21.5 ft (at recirculation pump). Liquid depth in the ponded areas of the moat was about 1.5 ft. Sludges in the moat were about 2 ft deep.

During the initial survey, the moat served as secondary containment for leachate from the Taylor Lake pond system. The collected leachate was then pumped back into Taylor Lake at the northwest corner of that pond and the wastewater flows directly into the Cell Room Pond as described previously. This moat was closed and covered during July, 1981 by Pennwalt.

Seven vertical sludge samples and a grab composite liquid sample were obtained from this moat. Analytical results from these seven sludge samples, from a composite sludge sample made up from the individual samples,

and from the composite liquid sample are presented in Tables 3-12 and 3-13. The sludge samples ranged from almost neutral to alkaline in pH, were high in salt content, relatively moist, and most of the samples were only a little more dense than water. The sludges would not hold a man's weight. From Table 3-13, the sludge in the moat is classified as a nonhazardous waste according to EPA's EP Toxicity standards.

The composite supernatant sample was slightly acidic, brackish, and had a free residual chlorine concentration that was about 50 percent of the Cell Room Pond concentration. From Table 3-13, the supernatant in the moat is classified as a nonhazardous waste according to EPA's EP toxicity standards.

3.3.1.7 Storm Runoff Ditch. A storm runoff ditch is located at the base of the outside dike of the Taylor Lake Moat. The ditch drains approximately 8 to 10 acres of the southeastern portion of the Pennwalt property. It also receives some leachate from the Taylor Lake Moat. The ditch discharges via a PVC pipe into the East Drainage Ditch.

Two sludge samples and a water composite from the ditch were collected and analytical results are presented in Tables 3-14 and 3-15. The sludges were alkaline in pH, had a high salt content, and had a medium moisture content. The sludges and the general area east from the Taylor Lake area will not support a man's weight. From EP Toxicity test results given in Table 3-15, the sludges are classified as a nonhazardous waste.

The water composite was alkaline, but not as high as most of the supernatant in the ponds; brackish; and had very little total residual

TABLE 3-12

WASTE CHARACTERIZATION - TAYLOR LAKE MOAT

Waste Disposal Area : Taylor Lake Area
Surface Area : 0.27 acres
Dike Minimum Elevation : 24.1 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 19.9-20.7 ft msl | 21.4-22.2 ft msl |
| Depth: | 2.0 ft | 1.5 ft |
| Volume: | 970 cu yds | 127,000 gal |

Status: Active - Lagoons runoff and leachate collection

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-F-S1 | 10.05 | 14,000 | 92 | 75 |
| PT-F-S2 | 11.20 | 22,000 | 73 | 69 |
| PT-F-S3 | 12.05 | 44,000 | 72 | 69 |
| PT-F-S4 | 11.25 | 19,000 | 59 | 81 |
| PT-F-S5 | 12.10 | 50,000 | 47 | 119 |
| PT-F-S6 | 7.35 | 13,000 | 60 | 75 |
| PT-F-S7 | 7.80 | 7,000 | 64 | 106 |
| PT-F-Composite | 11.65 | -- | 64 | 81 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine | |
|---|---|---|---|---|
| | | | Free (mg/l) | Total (mg/l) |
| PT-F-WC | 6.20 | 11,500 | 800 | 800 |

TABLE 3-13

HAZARDOUS WASTE ANALYSES
TAYLOR LAKE MOAT (ACTIVE)*
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.65 | 6.20 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.44 | 0.04 | 5.0 |
| Ba | < 0.5 | 0.1 | 100.0 |
| Cd | < 0.02 | 0.007 | 1.0 |
| Cr | 0.1 | 0.40 | 5.0 |
| Pb | < 0.1 | 0.005 | 5.0 |
| Hg | <0.005 | 0.008 | 0.2 |
| Se | <0.01 | 0.01 | 1.0 |
| Ag | < 0.1 | 0.002 | 5.0 |
| Cr(hex) | < 0.1 | 0.01 | |
| Endrin | <0.0008 | -- | 0.02 |
| Lindane | <0.004 | -- | 0.4 |
| Methoxychlor | <0.010 | -- | 10.0 |
| Toxaphene | <0.010 | -- | 0.5 |
| 2,4-D | <0.008 | -- | 10.0 |
| 2,4,5-TP Silvex | <0.008 | -- | 1.0 |
| Classification | non-hazardous | non-hazardous | |

*Filled by Pennwalt - July, 1981.

TABLE 3-14

WASTE CHARACTERIZATION - STORM RUNOFF DITCH

Waste Disposal Area : Taylor Lake Area
Surface Area : Drains about 8 to 10 acres
Dike Minimum Elevation : Ground surface in area ranges from about 20.4-22.4 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | -- | 17.9-21.9 ft msl |
| Depth: | -- | -- |
| Volume: | -- | -- |

Status: Active - area leachate and stormwater drainage

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-FF-S1 | 9.25 | -- | 43 | 100 |
| PT-FF-S2 | 11.15 | >50,000 | 56 | 87 |
| PT-FF-SC | 11.25 | -- | 48 | 94 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine | |
|---|---|---|---|---|
| | | | Free (mg/l) | Total (mg/l) |
| PT-FF-WC | 9.50 | 5,000 | 3 | 3 |

TABLE 3-15

HAZARDOUS WASTE ANALYSES
STORM RUNOFF DITCH (ACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.25 | 9.50 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.2 | 4.0 | 5.0 |
| Ba | <0.5 | 0.1 | 100.0 |
| Cd | <0.02 | 0.002 | 1.0 |
| Cr | <0.1 | 0.051 | 5.0 |
| Pb | 0.1 | 0.005 | 5.0 |
| Hg | <0.005 | 0.019 | 0.2 |
| Se | 0.01 | 0.01 | 1.0 |
| Ag | <0.1 | 0.002 | 5.0 |
| Cr(hex) | <0.1 | 0.04 | |
| Endrin | <0.0008 | -- | 0.02 |
| Lindane | <0.004 | -- | 0.4 |
| Methoxychlor | <0.008 | -- | 10.0 |
| Toxaphene | <0.010 | -- | 0.5 |
| 2,4-D | <0.010 | -- | 10.0 |
| 2,4,5-TP Silvex | <0.008 | -- | 1.0 |
| Classification | non-hazardous | non-hazardous | |

chlorine. From EP Toxicity test results given in Table 3-15, the supernatant in the ditch are classified as nonhazardous wastes.

3.3.1.8 Spent Blasting Sands Waste Pile. Sands obtained from Asarco of Tacoma are used on-site for sandblasting, fill material and dike material. The sand is easily recognizable by its green color. It is primarily found on Pennwalt's site around the sandblasting shed located between the Taylor Lake area and the Hylebos Waterway.

A grab sample of the sands was obtained from the sandblasting shed area and analytical results of the sand characteristics are given in Tables 3-16 and 3-17. The sand was slightly alkaline, very low in salt content, dry, had a density typical of sand, and can be characterized as being basically inert. From EP Toxicity test results given in Table 3-17, the sands are classified as nonhazardous wastes.

3.3.1.9 Summary of Taylor Lake Area. The Taylor Lake area is the primary solid waste disposal area on-site. It covers about 3 acres and primary wastes being sent to the ponds include:

1. 25,000 to 30,000 gal/month liquid wastes (as one batch discharge) containing 1,375 lb of asbestos contaminated solids.
2. 30,000 to 40,000 gpd of chlorine condensate.
3. 365 ton/yr of brine sludges.

The area has also received in the past 75,000 to 100,000 lb of chlorine impurities containing chloroform and some hexavalent chrome (associated with chlorate wastes). No listed hazardous wastes (specific or nonspecific sources) are presently being sent to the Taylor Lake area.

TABLE 3-16

WASTE CHARACTERIZATION - SPENT BLASTING SANDS

Waste Disposal Area: Taylor Lake Area -- Sand Blasting Shed

Status: Active - local product used for sand blasting

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-L-S1 | 8.50 | 4 | 7 | 100 |

TABLE 3-17

HAZARDOUS WASTE ANALYSES
SPENT BLASTING SANDS
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 8.50 | [a] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | <0.01 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | <0.1 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | <0.008 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | | | |

[a]No standing water associated with these sands.

The corrosivity and EP Toxicity test results for the ponds in the Taylor Lake area have been previously presented in Tables 3-1 through 3-17. It was found that the Taylor Lake area solid and liquid wastes are nonhazardous according to current EPA definition.

### 3.3.2 Wypenn Pond

The Wypenn Pond area encompasses a total area of about 0.2 acres and consists of Wypenn Pond and an adjacent depression that collects storm-waters and leachates. A closed disposal area, the Ag Chem site, is also located in this area but will be discussed separately under the closed site descriptions. A schematic of the sampling locations for this area is presented in Figure 3-3.

Wypenn Pond was constructed in 1970, is oblong in shape and only covers about 0.07 acres. The pond was receiving a discharge from an adjacent oil skimmer and the Ag Chem Building basement water during the initial field survey; however, it has since been closed by grading and landscaping by Pennwalt. In the past, the pond also received laboratory sink drainages.

The minimum top elevation of the pond's dike is about 24.3 ft MSL. The standing liquid in the pond is at about 23.0 ft MSL and liquid depth is around 2 ft. The sludge surface is at about Elevation 21.0 ft MSL and total sludge depth is about 2 ft.

Two vertical sludge samples and one grab liquid sample were obtained from this pond and analytical results are given in Tables 3-18 and 3-19. The sludges were alkaline in pH, high in salt content, had a very high moisture content, and were just slightly more dense than water. From EP

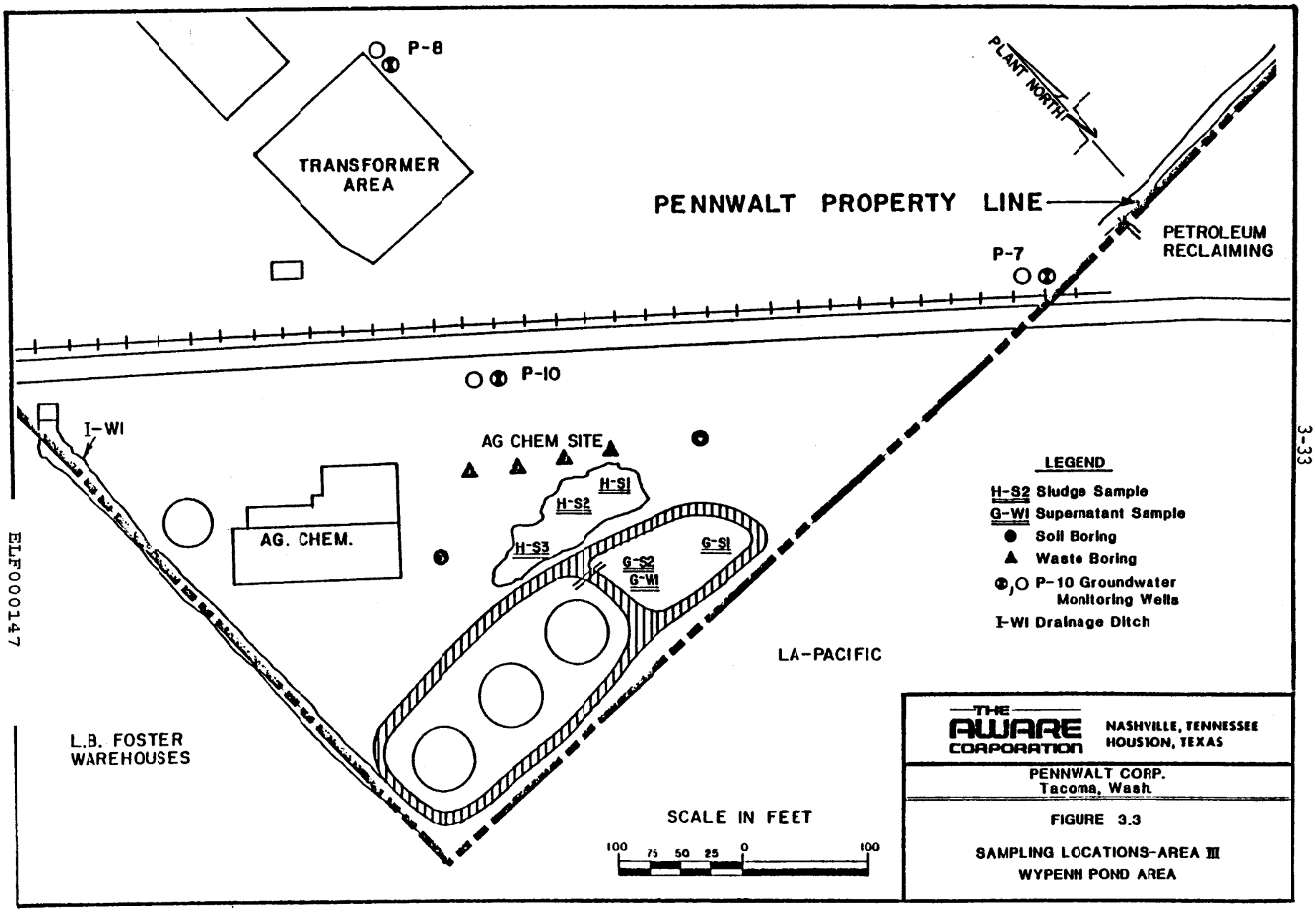

P-8
TRANSFORMER AREA
PLANT NORTH
PENNWALT PROPERTY LINE
PETROLEUM RECLAIMING
P-7
P-10
I-WI
AG CHEM SITE
AG. CHEM.
H-S1
H-S2
H-S3
G-S1
G-S2
G-WI
LA-PACIFIC
L.B. FOSTER WAREHOUSES
LEGEND
H-S2 Sludge Sample
G-WI Supernatant Sample
Soil Boring
Waste Boring
P-10 Groundwater Monitoring Wells
I-WI Drainage Ditch
SCALE IN FEET
100 75 50 25 0 100
THE AWARE CORPORATION
NASHVILLE, TENNESSEE
HOUSTON, TEXAS
PENNWALT CORP.
Tacoma, Wash.
FIGURE 3.3
SAMPLING LOCATIONS-AREA III
WYPENN POND AREA

TABLE 3-18

WASTE CHARACTERIZATION - WYPENN POND

Waste Disposal Area : Ag Chem Area
Surface Area : 0.07 acres
Dike Minimum Elevation : 24.3 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 21.0 ft msl | 23.0 ft msl |
| Depth: | 2.0 ft | 2.0 ft |
| Volume: | 240 cu yds | 49,000 gal |

Status: Active - recycle of oil wastes

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-G-S1 | 12.20 | 29,000 | 91 | 69 |
| PT-G-S2 | 12.25 | 31,000 | 95 | 75 |
| PT-G-SC | 12.20 | 30,000 | 95 | 75 |

| Sample No. | Supernatant pH | Conductivity (micromhos/cm) | Residual Chlorine Free (mg/l) | Residual Chlorine Total (mg/l) |
|---|---|---|---|---|
| PT-G-W1 | 12.30 | 30,000 | <0.1 | <0.1 |

TABLE 3-19

HAZARDOUS WASTE ANALYSES
WYPENN POND (ACTIVE)*
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 12.20 | 12.30 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 1.7 | 2.5 | 5.0 |
| Ba | 0.5 | 0.1 | 100.0 |
| Cd | < 0.02 | 0.002 | 1.0 |
| Cr | < 0.1 | 0.005 | 5.0 |
| Pb | 0.2 | 0.030 | 5.0 |
| Hg | 0.021 | 0.005 | 0.2 |
| Se | < 0.01 | 0.01 | 1.0 |
| Ag | < 0.1 | 0.005 | 5.0 |
| Cr(hex) | < 0.1 | 0.01 | |
| Endrin | < 0.0008 | -- | 0.02 |
| Lindane | < 0.004 | -- | 0.4 |
| Methoxychlor | < 0.010 | -- | 10.0 |
| Toxaphene | < 0.010 | -- | 0.5 |
| 2,4-D | < 0.010 | -- | 10.0 |
| 2,4,5-TP Silvex | < 0.008 | -- | 1.0 |
| Classification | non-hazardous | non-hazardous | |

*Closed by Pennwalt.

Toxicity test results given in Table 3-19, the sludges in the lagoon are classified as nonhazardous wastes.

The supernatant in the pond was alkaline in pH, similar to seawater in its conductivity and had no residual chlorine concentrations. From EP Toxicity test results given in Table 3-19, the supernatant in the pond is classified as a nonhazardous waste.

3.3.2.1 Wypenn Stormwater Pond. The depression adjacent to Wypenn Pond covers about 0.1 acre. The ground surface elevation in this area is about 21 ft MSL and the surficial soils are contaminated with oil.

Three vertical sludge samples were obtained from this depression and analytical results are given in Tables 3-20 and 3-21. The depression contained no standing water on the date sampled. The surficial soil samples were alkaline in pH, had a comparatively low salt content (in relationship to other ponds' sludges), and had a low moisture content. From EP Toxicity test results given in Table 3-21, the surficial soils are classified as nonhazardous wastes.

### 3.3.3 Waggoners Wallow

Waggoners Wallow consists of a singular maze of moats that covers about 0.36 acres. A schematic of the sampling locations in this area is presented in Figure 3-4. Waggoners Wallow was constructed around 1969 for treatment (natural decomposition to brine) of absorber liquor. At present, the moat system periodically receives about 3,000 to 7,000 gal/wk of sodium hypochlorite from the absorber tanks, and offgas from the chlorine process.

TABLE 3-20

WASTE CHARACTERIZATION - WYPENN STORMWATER POND

Waste Disposal Area : Ag Chem Area
Surface Area : ~0.1 acre
Dike Minimum Elevation : Area Elev. ~20 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 20 ft msl | -- |
| Depth: | surficial | -- |
| Volume: | -- | -- |

Status: Active - stormwater hold-up and leachate collection

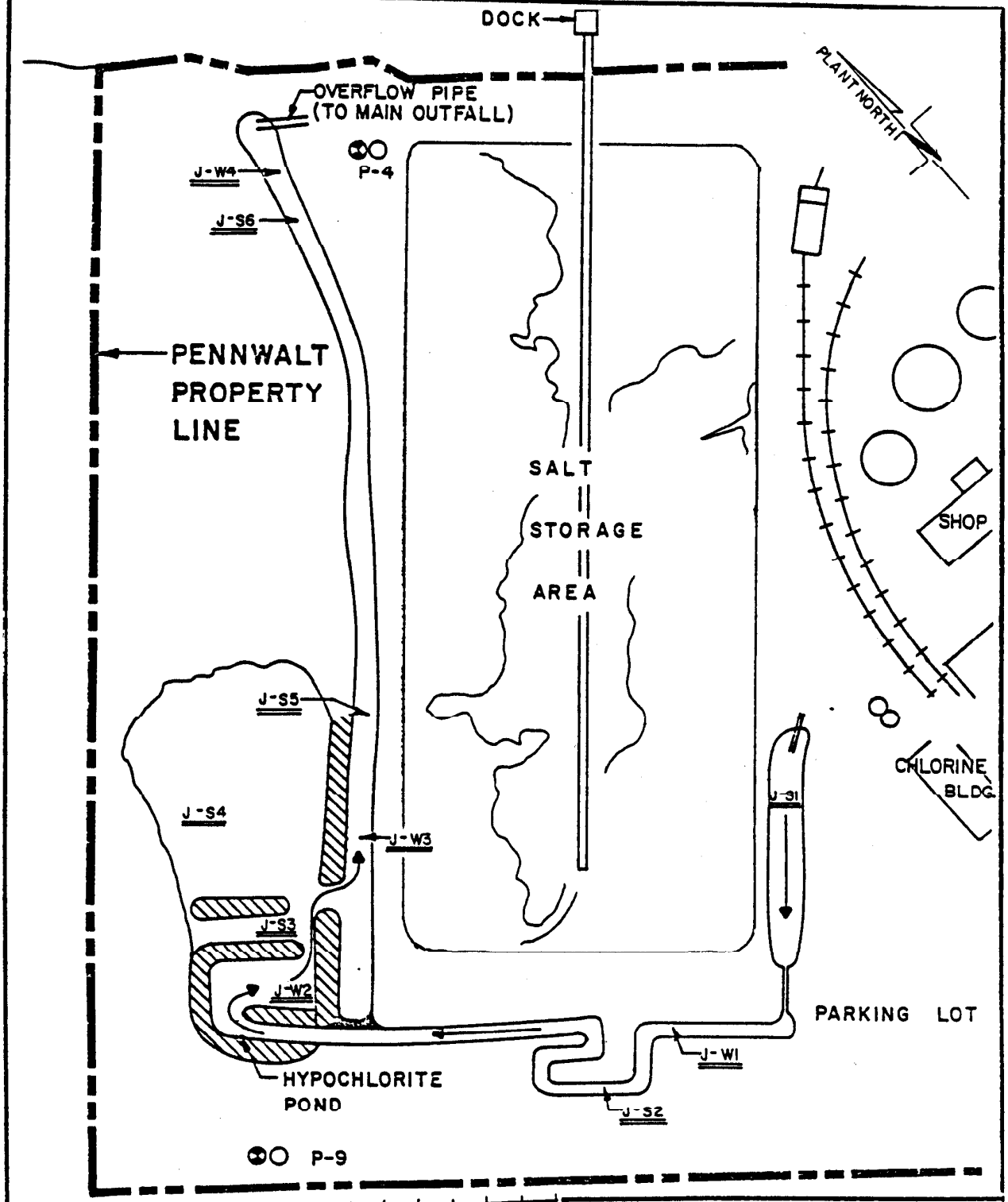
| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-H-S1 | 11.75 | 8,200 | 30 | 112 |
| PT-H-S2 | 11.95 | 3,000 | 29 | 112 |
| PT-H-S3 | 11.55 | 2,600 | 28 | 112 |
| PT-H-SC | 11.85 | 8,000 | 24 | 112 |

TABLE 3-21

HAZARDOUS WASTE ANALYSES
WYPENN STORMWATER POND (ACTIVE)*
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 11.85 | [a] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.17 | | 5.0 |
| Ba | < 0.5 | | 100.0 |
| Cd | < 0.02 | | 1.0 |
| Cr | < 0.1 | | 5.0 |
| Pb | 0.1 | | 5.0 |
| Hg | < 0.005 | | 0.2 |
| Se | < 0.01 | | 1.0 |
| Ag | < 0.1 | | 5.0 |
| Cr(hex) | < 0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | <0.008 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]No standing water in pond on date sampled.
*Closed by Pennwalt.




LEGEND

J-S4 Sludge Sample

J-WI Supernatant Sample

P-4 Groundwater Monitoring Wells

SCALE IN FEET

100 75 50 25 0 100

THE AWARE CORPORATION

NASHVILLE, TENNESSEE
HOUSTON, TEXAS

PENNWALT CORP.
Tacoma, Wash.

FIGURE 3.4

SAMPLING LOCATIONS-AREA III
WAGGONERS WALLOW AREA

No dike surrounds the moat and natural ground surface in the area is around elevation 21 to 23 ft MSL. The moat is about 4 ft deep and supernatant depth varies with discharges. Soft natural materials in the moat are about 2 to 3 ft thick.

Six vertical sludge samples and a composite grab liquid sample were obtained from the moat system and analytical results are given in Tables 3-22 and 3-23. The sludges were alkaline in pH; were close to the saturation limit in salt content; and had medium moisture content. From EP Toxicity test results on the composite sludge sample, the sludges in the moat are classified as nonhazardous wastes.

The supernatant composite sample was moderately alkaline. From EP Toxicity test results presented in Table 3-23, the supernatant in Waggoners Wallow is classified as a nonhazardous waste.

### 3.3.4 Inactive Sites

The Ag Chem Waste Pits area and the Penite Waste Pit/Ponds area (Figure 3-1) are inactive sites that were used during past production research activities at the site. Waste sampling locations are shown in Figure 3-1.

3.3.4.1 Ag Chem Site. The Ag Chem waste disposal area consisted of three pits located to the east of the Ag Chem Building. Each pit was about 8 ft in diameter and 10 ft deep. Bottles and drums of various chemicals and solvents associated with herbicide/pesticide laboratory research were disposed in the pits. The pits were covered with local soil material and grassed. Pit locations are identifiable today as slight depressions in the flat topography.

TABLE 3-22

WASTE CHARACTERIZATION - WAGGONERS WALLOW

Waste Disposal Area : Waggoners Wallow - west of salt storage piles
Surface Area : 0.36 acres
Dike Minimum Elevation : Ground surface around pond ranges from about 21-23 ft msl

| | Sludge | Supernatant |
|---|---|---|
| Surface Elev: | 20.6 ft msl | 20.9 ft msl |
| Depth: | 2.6 ft | 0.3 ft |
| Volume: | 1,520 cu yds | 40,000 gal |

Status: Active - liquid wastes only

| Sludge Sample No. | pH | Conductivity (micromhos/cm) | Moisture Content (%) | Density (lb/cu ft) |
|---|---|---|---|---|
| PT-J-S1 | 12.20 | 74,000 | 28 | 119 |
| PT-J-S2 | 11.65 | 220.000 | 49 | 106 |
| PT-J-S3 | 10.45 | 250,000 | 57 | 87 |
| PT-J-S4* | 8.20 | 58,000 | 37 | 194 |
| PT-J-S5 | 9.10 | 280,000 | 50 | 87 |
| PT-J-S6 | 8.45 | 136,000 | 43 | 94 |
| PT-J-SC | 10.85 | 141,000 | 47 | 94 |

| Supernatant Sample No. | pH | Conductivity (micromhos/cm) | Residual Chlorine Free (mg/l) | Residual Chlorine Total (mg/l) |
|---|---|---|---|---|
| PT-J-WC | 9.15 | offscale >50,000 | 3,900 | 4,300 |

*Sample out of main flow path.

TABLE 3-23

HAZARDOUS WASTE ANALYSES
WAGGONERS WALLOW (ACTIVE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | 10.85 | 9.15 | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.63 | 0.12 | 5.0 |
| Ba | 1.1 | 0.1 | 100.0 |
| Cd | <0.02 | 0.002 | 1.0 |
| Cr | 0.1 | 0.093 | 5.0 |
| Pb | 0.2 | 0.029 | 5.0 |
| Hg | <0.005 | 0.002 | 0.2 |
| Se | 0.01 | 0.01 | 1.0 |
| Ag | 0.1 | 0.006 | 5.0 |
| Cr(hex) | <0.1 | 0.01 | |
| Endrin | <0.0008 | -- | 0.02 |
| Lindane | <0.004 | -- | 0.4 |
| Methoxychlor | <0.010 | -- | 10.0 |
| Toxaphene | <0.010 | -- | 0.5 |
| 2,4-D | <0.008 | -- | 10.0 |
| 2,4,5-TP Silvex | <0.008 | -- | 1.0 |
| Classification | non-hazardous | non-hazardous | |

A total of five boring soil samples were made into the disposal area. No leachate samples were collected. EP Toxicity tests were conducted on selected samples and analytical results are presented in Tables 3-24 to 3-27. According to EP Toxicity standards, soil/sludge samples collected from the Ag Chem disposal area are nonhazardous.

3.3.4.2 Penite Site. The Penite site (Figure 3-1) was located northeast from the Penite Building (discontinued sodium arsenite herbicide production). According to plant personnel, the disposal area consisted of three separate ponds and one burial pit. The area was utilized for solid and liquid wastes disposal from about 1939 to 1974. The waste materials included: Penite sludges, pipes containing Penite sludge, drums of various plant wastes, and drums of Ag Chem wastes. The major contaminant of concern in this old disposal site field is arsenic.

A total of three borings were initially made into the suspected disposal area with samples collected at 5-ft intervals. No leachate samples were obtained. EP Toxicity tests were conducted on split-spoon soil samples and analytical results are presented in Tables 3-28 and 3-29. Nine additional test borings were drilled in the Penite area to more accurately define disposal site locations. This drilling program is discussed in Section 4.

TABLE 3-24

HAZARDOUS WASTE ANALYSES
AGCHEM-1 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge[a] | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 0.03 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | <0.1 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.015 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 2.5 to 4.0 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

TABLE 3-25

HAZARDOUS WASTE ANALYSES
AGCHEM-2 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge[a] | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | <0.01 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | 0.3 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.008 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 2.5 to 4.0 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

TABLE 3-26

HAZARDOUS WASTE ANALYSES
AGCHEM-3 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge[a] | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 1.2 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | <0.1 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.008 | | 10.0 |
| 2,4,5-TP Silvex | 0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 2.5 to 4.0 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

TABLE 3-27

HAZARDOUS WASTE ANALYSES
AGCHEM-4 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample[a] Sludge | Supernatant | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| Corrosivity | | | |
| pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | <0.01 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | 0.3 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.021 | | 10.0 |
| 2,4,5-TP Silvex | 0.008 | | 1.0 |
| Classification | non-hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 2.5 to 4.0 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

TABLE 3-28

HAZARDOUS WASTE ANALYSES
PENITE 1 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample | | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| | Sludge[a] | Supernatant | |
| Corrosivity | | | |
| pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 52 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | <0.02 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | 0.2 | | 5.0 |
| Hg | <0.005 | | 0.2 |
| Se | 0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.021 | | 10.0 |
| 2,4,5-TP Silvex | <0.008 | | 1.0 |
| Classification | hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 3 to 4.5 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

TABLE 3-29

HAZARDOUS WASTE ANALYSES
PENITE 2 (CLOSED SITE)
PENNWALT - TACOMA, WASHINGTON

| Parameter | Composite Sample[a] Sludge | Composite Sample[a] Supernatant | U.S. EPA Hazardous Waste Characteristic |
|---|---|---|---|
| Corrosivity pH (S.U.) | -- | [b] | 2.0 > pH > 12.5 |
| EP Toxicity (mg/l) | | | |
| As | 300 | | 5.0 |
| Ba | <0.5 | | 100.0 |
| Cd | 0.13 | | 1.0 |
| Cr | <0.1 | | 5.0 |
| Pb | <0.1 | | 5.0 |
| Hg | 0.007 | | 0.2 |
| Se | <0.01 | | 1.0 |
| Ag | <0.1 | | 5.0 |
| Cr(hex) | <0.1 | | |
| Endrin | <0.0008 | | 0.02 |
| Lindane | <0.004 | | 0.4 |
| Methoxychlor | <0.010 | | 10.0 |
| Toxaphene | <0.010 | | 0.5 |
| 2,4-D | 0.024 | | 10.0 |
| 2.4.5-TP Silvex | <0.008 | | 1.0 |
| Classification | hazardous | | |

[a]Composite sample from split-spoon soil/residue samples taken between 2.5 to 4.5 ft and 6.0 to 7.5 ft.

[b]No water associated with sample.

# SECTION 4

# SITE CHARACTERIZATION

## 4.1 INTRODUCTION

This section reviews and discusses pertinent site characteristics which effect or control the ultimate movement of potential contaminants at the facility. As part of this site characterization, comprehensive groundwater, soil, and surface water investigative/sampling programs were implemented at the Pennwalt facility. These investigative/sampling programs were developed based upon the following criteria:

1. Location, size, and depth of current and past waste management operations.
2. Chemical characteristics of wastestreams at individual waste management operations.
3. Potential concentration and mobility of known or suspected contaminants.
4. Locations of suspected off-site sources of contaminants.
5. Site specific hydrogeologic information including depth to groundwater, direction, and rate of groundwater flow, and ambient groundwater quality.
6. Site specific geological information including vertical and areal distribution of geologic materials, and their physical and chemical characteristics.
7. Site specific surface drainage conditions including seep discharges along the waterway.

Output from these investigative/monitoring programs were intended to be utilized for subsequent evaluation of the actual or potential impact to the underlying groundwater system and the impact to the Hylebos Waterway as a result of clearly identifiable discharges, runoff, and seepage zones as well as diffuse groundwater discharges.

## 4.2 TOPOGRAPHY

The Pennwalt plant is located along the Hylebos Waterway in the Tacoma industrial area of Commencement Bay (Figure 2-1). The general area was at one time a salt marsh that was filled in during the 1920's to provide industrial sites for the Tacoma area. Several ship canals were dredged into the old salt marsh to provide ocean access for industrial sites further from Commencement Bay. Today, the general industrial area is basically flat with ground surface elevations around 20 ft MSL. A steep ridge with elevations up to about 400 ft MSL rises to the northeast of the Hylebos Waterway, and the base of this ridge physically provides one boundary of the industrial area. Commencement Bay lies to the north; the town of Fife, light industry, and residential areas, and U.S. Interstate-5 lie in a gently rising valley to the south; and the city of Tacoma lies to the west on another ridge with elevations up to about 400 ft MSL.

The Pennwalt plant is around elevation 23 ft MSL with high areas in the western part of the property around Elevation 26 ft MSL and low areas along the eastern part of the property around Elevation 20 ft MSL. Most of the area around the various waste lagoons is around Elevation 20-23 ft MSL. The original bottom elevations of the waste lagoons are generally around 16 to 22 ft MSL. Dikes around the various lagoons range from elevation 23 to 26 ft MSL.

Pennwalt has one established elevation benchmark (BM) on-site. The following elevations have been determined for this BM:

| Source | Elevation |
|---|---|
| Pennwalt | 23.00 (believed to be ft MSL) |
| City of Tacoma | 25.06 |
| Army Corp of Engineers | 17.32 (believed to be MLLW) |

For purposes of this report, the Pennwalt BM elevation is used and this elevation approximates very closely to the National Geodetic Vertical Datum elevation for that BM as determined from a lower low water tidal elevation measurement on April 21, 1981.

The local mean sea level is based on the mean of the lower of the low tides for each day and is typically referenced (as an example) 0.0 ft MLLW. The local mean sea level datum in Seattle, Washington, has been determined to be 5.68 ft below the Datum for mean sea level based on the geodetic level net of the U.S. (National Geodetic Vertical Datum). The mean sea level datum at the Pennwalt plant site is thought to be about 5.7 ft. The Pennwalt BM elevation of 23.00 ft MSL (that is believed to approximate the National Geodetic Vertical Datum) is actually about 5.7 ft higher than an elevation based on "local" mean sea level. Tidal heights reported by the National Ocean Survey are in ft above or below local mean sea level. Therefore at the Pennwalt site, a local mean sea level height of 0.0 ft MLLW is actually Elevation 5.7 ft MSL based on the National Geodetic Vertical Datum.

All elevations reported herein are consistent with ft MSL based on the Pennwalt BM Elevation that is assumed to be referenced to the National Geodetic Vertical Datum. All water elevation measurements reported herein are therefore 5.7 ft higher than the local mean sea level datum or MLLW estimated for the Tacoma site.

## 4.3 SURROUNDING WATER AND LAND USE

The Pennwalt plant site is located on the northern edge of the Tacoma-Commencement Bay Industrial Area. All of the local area around the site is used for industrial activities. The nearest residential areas to the site are located about one mile to the southeast in the town of Fife area and along the top of the ridge located about 0.8 mi to the north from the site (North Tacoma). The Pennwalt site, since its initial filling, has been used for the production of chemicals. Pennwalt also previously owned the present L.B. Foster site (located across Taylor Way from Pennwalt). The La-Pacific woodyards located to the south and east of the AgChem Building were previously occupied by Ohio-Ferro Alloys Company. A schematic of industries located along Taylor Way between the Hylebos Waterway and Blair Waterway is presented in Figure 4-1.

The Hylebos Waterway is used for ship access to industrial sites located along both edges of water of the Hylebos Waterway. Pennwalt withdraws about 10.2 MGD from the Hylebos for noncontact process cooling water. The Hylebos Waterway is basically salt water (minor freshwater input from Hylebos Creek) and is not used for any domestic or industrial sanitary water supply. Pennwalt obtains about 1.66 MGD of sanitary water supply from the City of Tacoma.

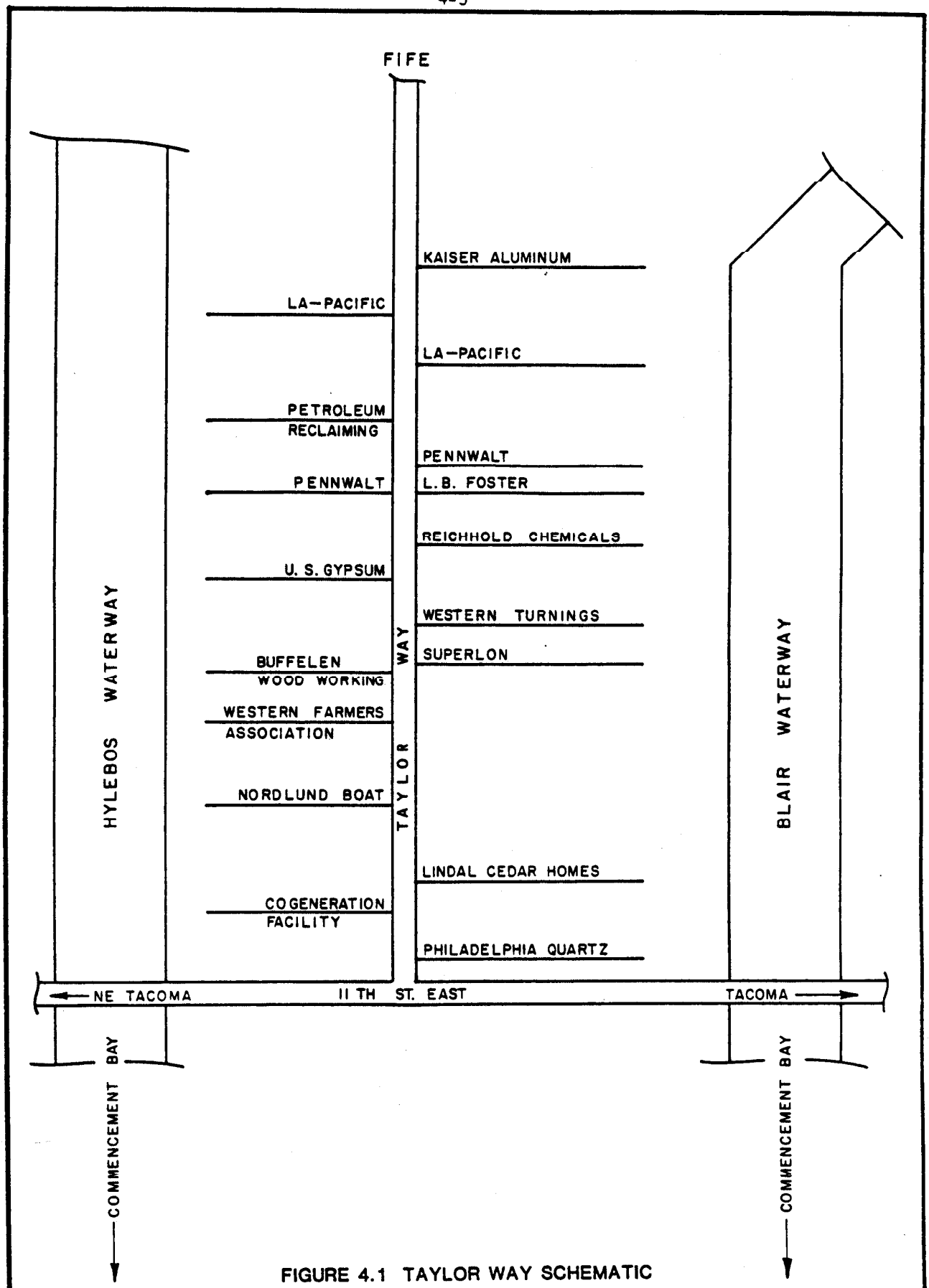



FIGURE 4.1 TAYLOR WAY SCHEMATIC

Commencement Bay, located about two miles downchannel from the Pennwalt site, is used for shipping, commercial fishing, and recreation. A marina is located on Commencement Bay at the mouth of the Hylebos Waterway.

## 4.4 CLIMATE

Climatological data were compiled from the 1980 Annual Summary Data Sheet for the Seattle-Tacoma Airport and also from eight months of record during 1980 for the Puyallup Station (evaporation data). The Sea-Tac Station is located six miles south of Seattle and 14 miles north-northeast of Tacoma. The station is operated by the National Weather Service. The Puyallup Station is located about 15 miles east from Tacoma, and this station is operated by the Western Washington Research Extension Center.

Average and extreme monthly rainfall and temperature data for the present Sea-Tac Station are presented in Table 4-1. Average rainfall for 36 years of record is about 39 in./yr with a range from about 24 to 55 in./yr. The maximum 24-hr rainfall recorded was 3.41 in. (November, 1959) and monthly extreme rainfalls have ranged from a trace (July, 1960 and September, 1975) to 12.92 in. (January, 1953). For the general locality, the 24-hr and the maximum monthly and minimum monthly rainfalls ever recorded in the Seattle area have been 3.52 in. (December, 1921), 15.33 in. (December, 1933) and 0.00 in. (July, 1922 and earlier), respectively. More than 75 percent of the yearly rainfall falls from October 1 through March. December is the wettest month of the year but rainfall is rather evenly distributed through the winter and spring months. July to early August is usually the driest period of the year. Considerable cloudiness, particularly during the winter months, is prevalent in the

TABLE 4-1

TACOMA CLIMATOLOGICAL DATA

(Seattle-Tacoma Airport)

| Month | Monthly Precipitation (in.) | | | Monthly Temperature (°F) | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| January | 5.82 | 12.92 | 0.86 | 38.4 | 43.4 | 33.4 |
| February | 4.43 | 9.11 | 1.58 | 42.5 | 48.5 | 36.4 |
| March | 3.71 | 8.40 | 0.57 | 44.2 | 51.2 | 37.1 |
| April | 2.44 | 4.19 | 0.33 | 48.6 | 56.8 | 40.3 |
| May | 1.60 | 4.76 | 0.35 | 55.1 | 64.3 | 45.9 |
| June | 1.44 | 3.90 | 0.13 | 60.0 | 69.2 | 50.8 |
| July | 0.77 | 2.10 | T | 64.6 | 75.2 | 54.0 |
| August | 1.22 | 4.59 | 0.01 | 64.0 | 73.9 | 54.0 |
| September | 2.12 | 5.95 | T | 59.7 | 68.6 | 50.7 |
| October | 3.65 | 8.95 | 0.72 | 52.0 | 59.2 | 44.8 |
| November | 5.68 | 9.69 | 0.74 | 44.6 | 50.2 | 39.0 |
| December | 6.31 | 11.85 | 1.37 | 40.8 | 45.6 | 36.0 |
| Annual | 39.19 | 55.14 | 23.78 | 51.2 | 58.8 | 43.5 |

area, and the monthly total rainfall is typically in the form of light showers over a high percentage of the total days of the month.

Average yearly temperature is about 51° F while the monthly average temperature ranges from about 38° F in January to about 65° F in July. Daily low and high temperatures normally differ by about 10° to 20° F while daily extreme temperatures have ranged from a low of 0° F (January, 1950) to a high of 99° F (August, 1960). Typically, the average winter daytime temperatures are in the forties and the nighttime temperatures are in the thirties. Average summer daytime temperatures are in the seventies to low eighties, and nighttime temperatures are in the fifties.

Evaporation vs precipitation for the Puyallup Station is presented in Figure 4-2 and Table 4-2. For the March-November period, there is net evaporative loss of moisture for this station (12.03 in. rainfall vs 24.78 in. evaporation = -12.75 in. net loss).

For the Pennwalt site, net evaporative losses greater than rainfall can be expected from April through August or September. Evaporative losses (compared to rainfall) are minimal from October to the first of April.

## 4.5 GEOLOGY AND SOILS

### 4.5.1 Regional Geologic Conditions

The Pennwalt plant site is located on a former tidal flat or tidal marsh area produced by the formation of a delta advanced by the Puyallup River into Commencement Bay. After the advance and retreat of glaciers originating in western Canada, a major trough was excavated in the existing deposits by the continental ice which was to be Puget Sound and likewise

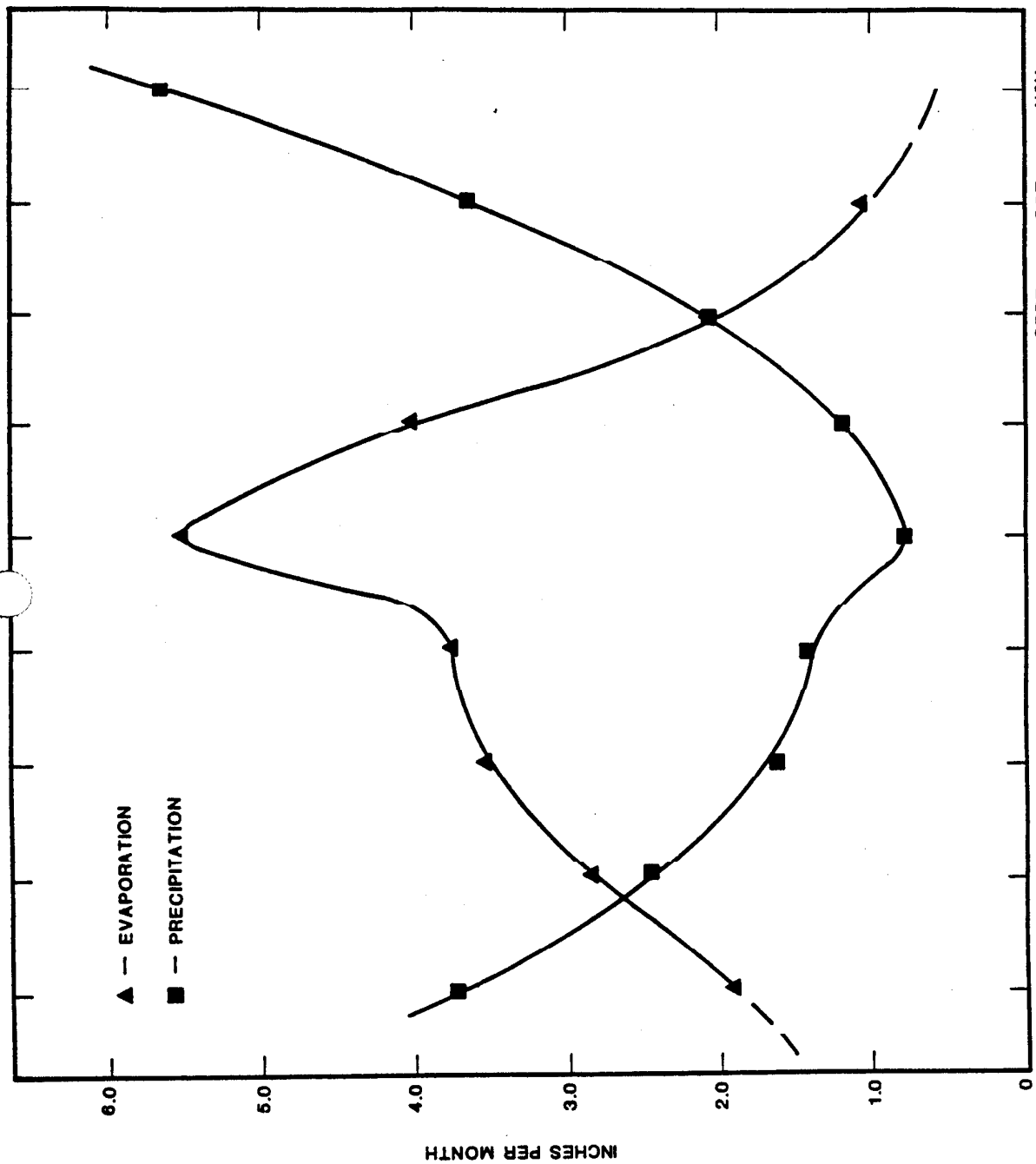



FIGURE 4.2 EVAPORATION VS. PRECIPITATION FOR THE PUYALLUP STATION, 1980

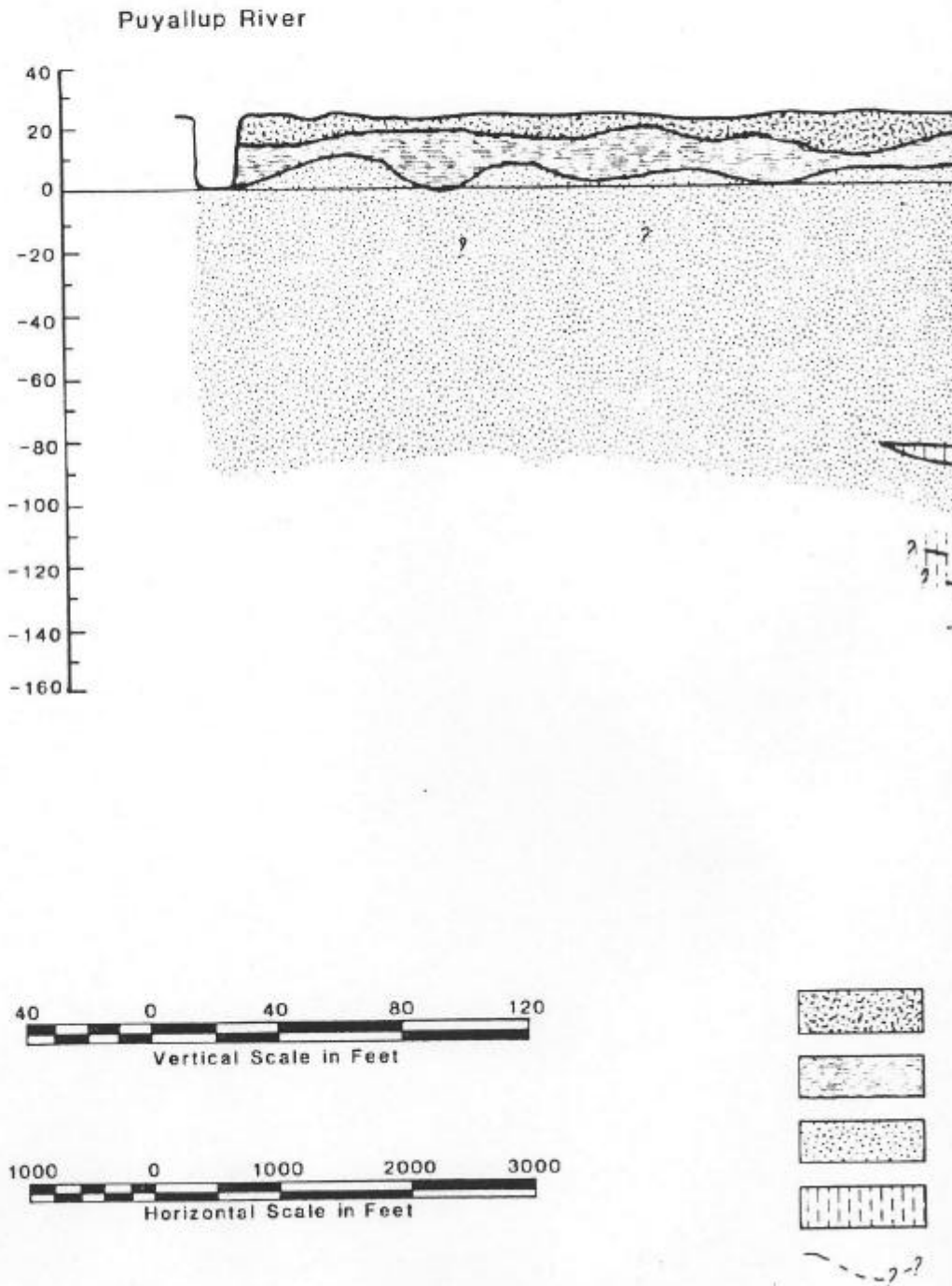
TABLE 4-2

EVAPORATION/RAINFALL FOR PUYALLUP, WA
For the Period from March-October, 1980

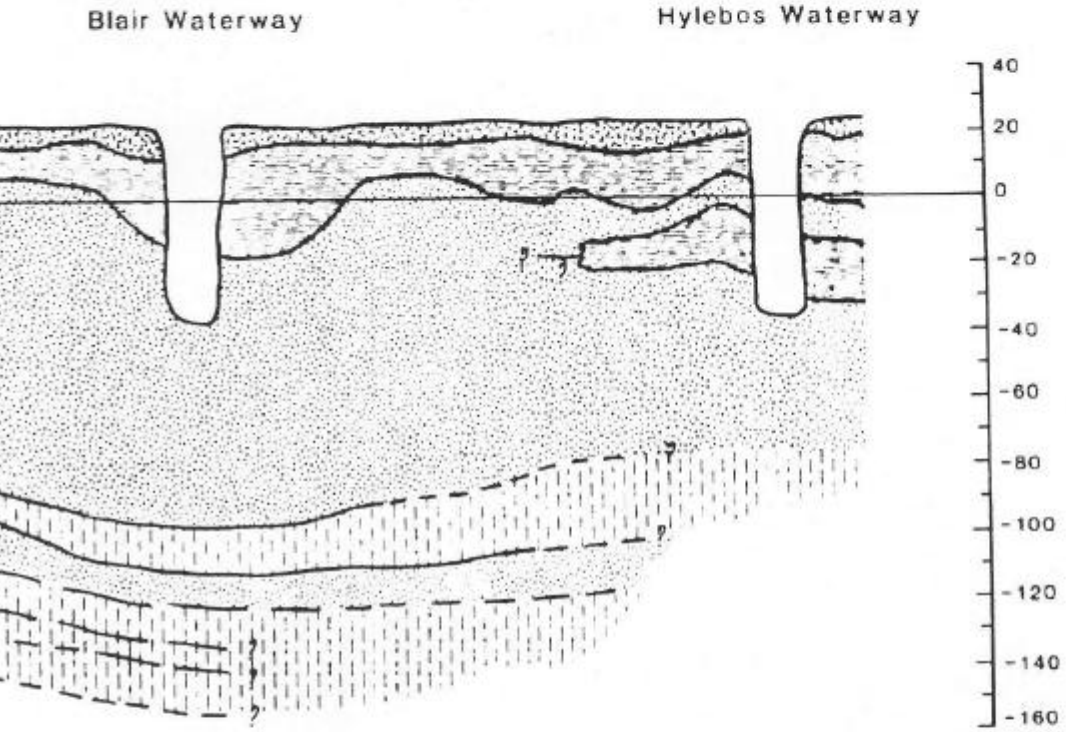
| Month | Evaporation Inches per Month | Evaporation Avg. (in./day) | Evaporation Max. (in./day) | Evaporation Min. (in./day) | Wind/day Avg. (miles of air over pan) | Rainfall (in.) |
|---|---|---|---|---|---|---|
| March | -- | 0.063 | 0.10 | 0.03 | 40 | 3.61 |
| April | 2.82 | 0.094 | 0.18 | 0.04 | 22 | 0.74 |
| May | 3.54 | 0.114 | 0.27 | 0.00 | 44 | 1.27 |
| June | 3.71 | 0.124 | 0.34 | 0.03 | 29 | 2.19 |
| July | 5.52 | 0.178 | 0.31 | 0.03 | 30 | 0.45 |
| August | 4.00 | 0.129 | 0.21 | 0.01 | 20 | 0.86 |
| September | 2.13 | 0.071 | 0.16 | 0.02 | 15 | 1.98 |
| October | 1.11 | 0.036 | 0.08 | 0.01 | 7 | 0.93 |
| Average | 3.26 in. | | | | 26 | 1.50 in. |
| Total | 24.78 in. | | | | 207 | 12.03 in. |

Commencement Bay (Hart Crowser and Associates, 1979). As the glaciers melted causing changes in sea level and subsequent deposition, and as the Puyallup River carried sediment down from the Cascade Range, the trough filled by an interlayering process. This process produced a complex setting consisting of interfingering sands, silts, and clays. Overlying these deeper interfingering sediments are units deposited by the more recent advancement of the Puyallup River Delta. These deposits have been differentiated into distinct zones representing different depositional sequences. These zones have been arbitrarily numbered I through IV, with Zone IV being the deepest (Figure 4-3). Zone IV is characterized by medium dense to dense sand with some silty sand. The top of this zone is typically encountered at elevations lower than -120 ft. Zone III, at elevations ranging from -70 to -120 ft, primarily consists of silt deposits with some interbedded sand units. Medium to dense sand and interbedded silt comprise Zone II. The top of this zone is present from just below ground surface to -25 ft with its base being present at between -70 and -110 ft. The gradational nature of this zone's contacts makes it difficult to specifically define its boundaries. Zone I consists of the uppermost deposits of the delta. These deposits are composed of silts and clayey silts probably representing the tidal marsh conditions of the most recent delta development. Included in these sediments are fibrous, organic materials, peat, clay, and some sand. This tidal marsh area, as documented in maps circa 1880's, was dissected by several small channels and streams.

The uppermost surficial deposits consist of artificially emplaced fill material. This fill varies regionally in composition from dredged




From: Hart-Crowser and Associates, 1




ER SILT (Zone 1)

LE SAND (Zone 2)

ER SILT (Zone 3)

acts: Dashed where inferred,
querried where speculated

THE AWARE CORPORATION
NASHVILLE, TENNESSEE
HOUSTON, TEXAS

PENNWLT CORP.
Tacoma, Wash.

FIGURE 4.3

GEOLOGIC CROSS SECTION OF
THE PUYALLUP DELTA

material to tilled agricultural material; in density from loose to artificially compacted; and in thickness from a few feet up to 25 ft. Fine to coarse sand and gravel with some silt predominate the fill.

### 4.5.2 Site Specific Geologic Conditions

Basically, the geologic deposits underlying the Pennwalt facility consist of interbedded and intermixed deltaic and alluvial sands, silts, and clays overlain by artificial fill (Figure 4-4). In order to define site specific geologic conditions and controls, detailed logs were maintained for the 30 groundwater monitoring wells and the 18 test borings drilled at the Pennwalt facility as part of this project (Appendices A and B for individual logs). In addition, split spoon samples were collected at 5-ft intervals in each of the wells and the three initial borings and were subsequently subjected to grain size analyses for classification purposes (Appendix D for results of grain size analysis).

Based upon the logs of the monitoring wells and test borings drilled at the Pennwalt facility as part of this project, five clearly defined continuous zones are present beneath the facility (Appendices A and B for logs of individual wells and borings). These five seperate zones are depicted in the representative lithologic cross-sections shown in Figures 4-5, 4-6, and 4-7. The cross-section in Figure 4-5 represents an east-west profile along the northern plant boundary near the Hylebos Waterway, and Figure 4-6 depicts an east-west profile along the southern plant boundary near Taylor Way. A north-south geologic profile is provided in Figure 4-7.

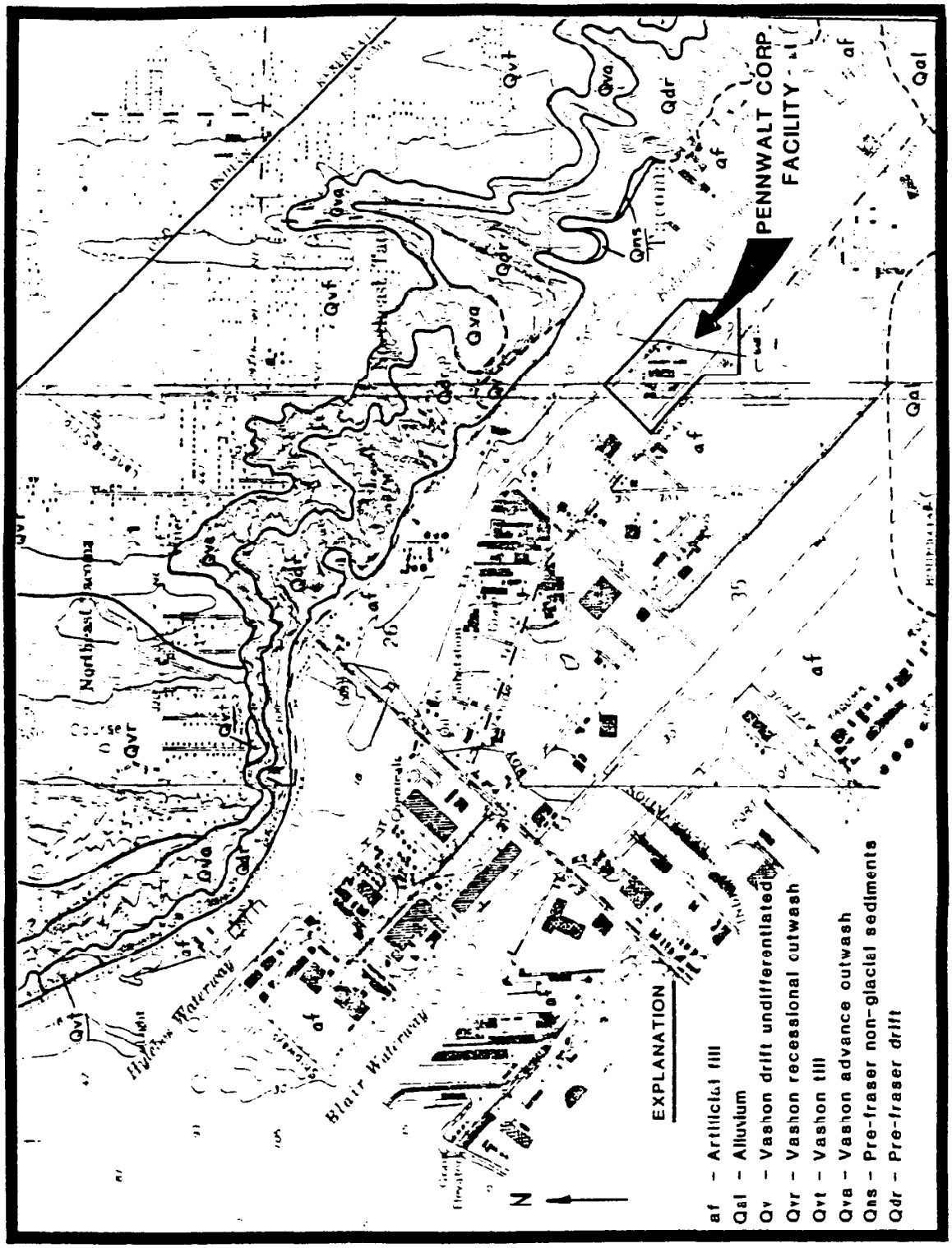
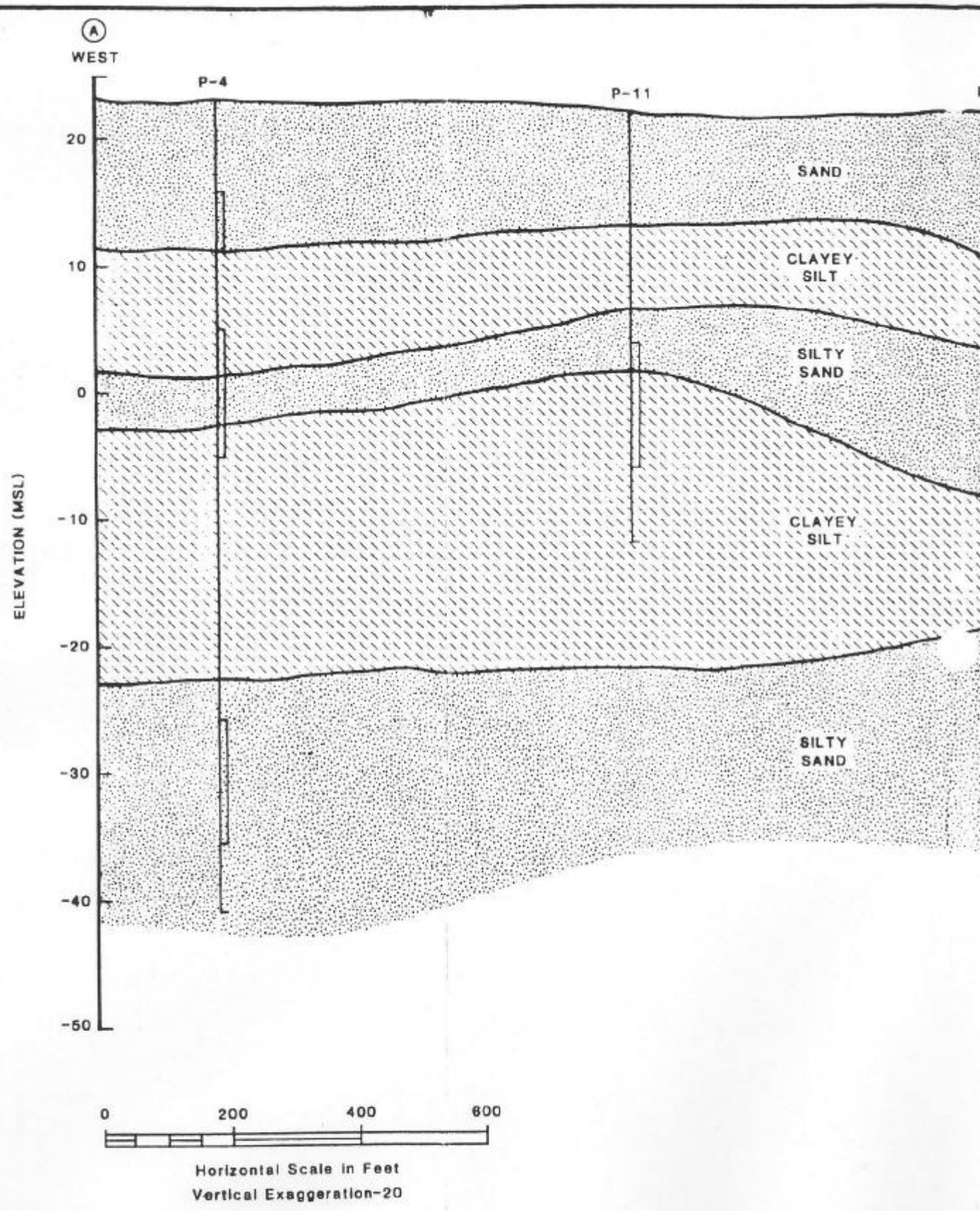
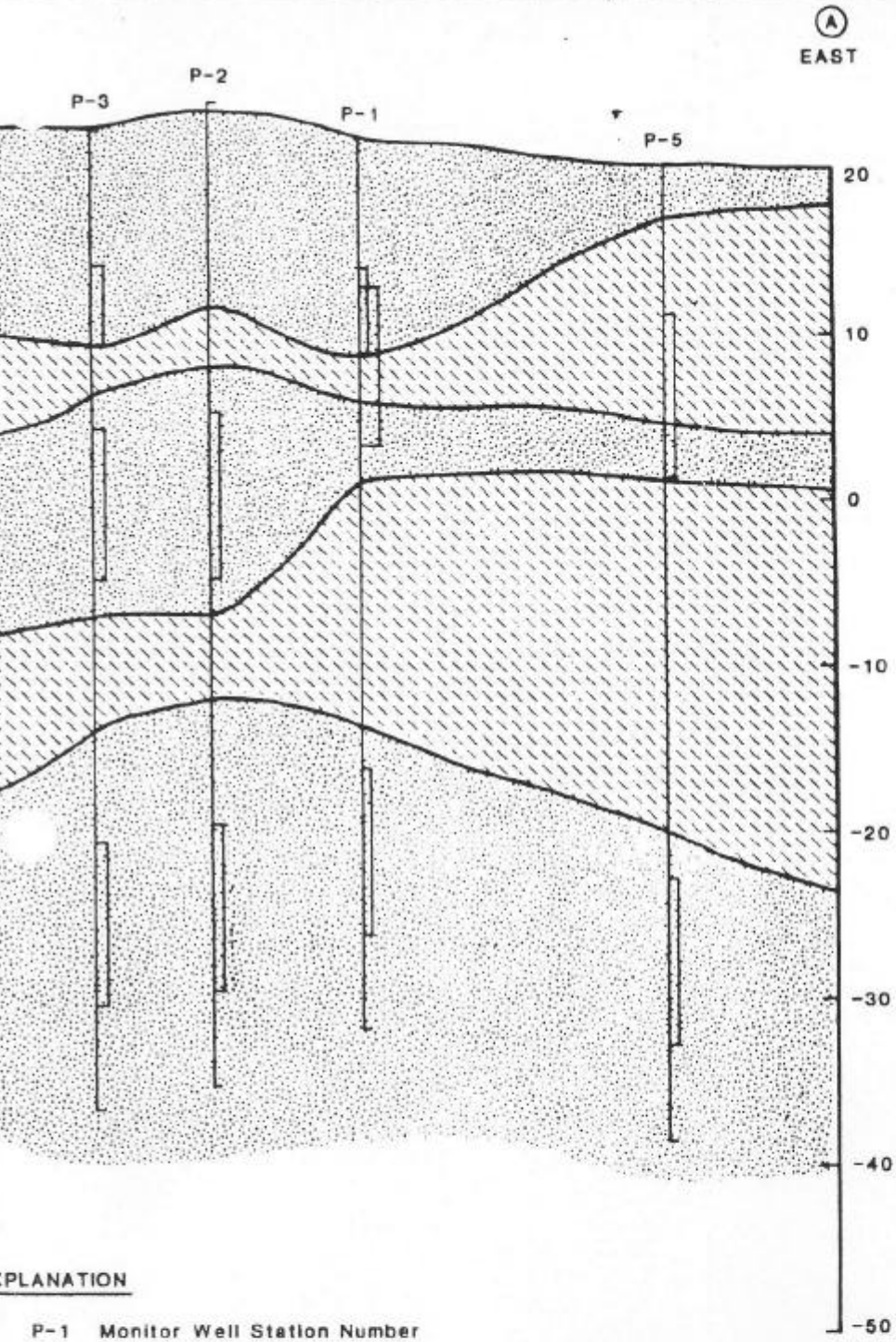



FIGURE 4.4 REGIONAL GEOLOGIC MAP OF A PORTION OF THE PORT OF TACOMA


A
WEST
P-4
P-11
20
10
0
-10
-20
-30
-40
-50
ELEVATION (MSL)
SAND
CLAYEY SILT
SILTY SAND
CLAYEY SILT
SILTY SAND
0
200
400
600
Horizontal Scale in Feet
Vertical Exaggeration-20

ELF000179




EXPLANATION

P-1 Monitor Well Station Number

Screen Interval

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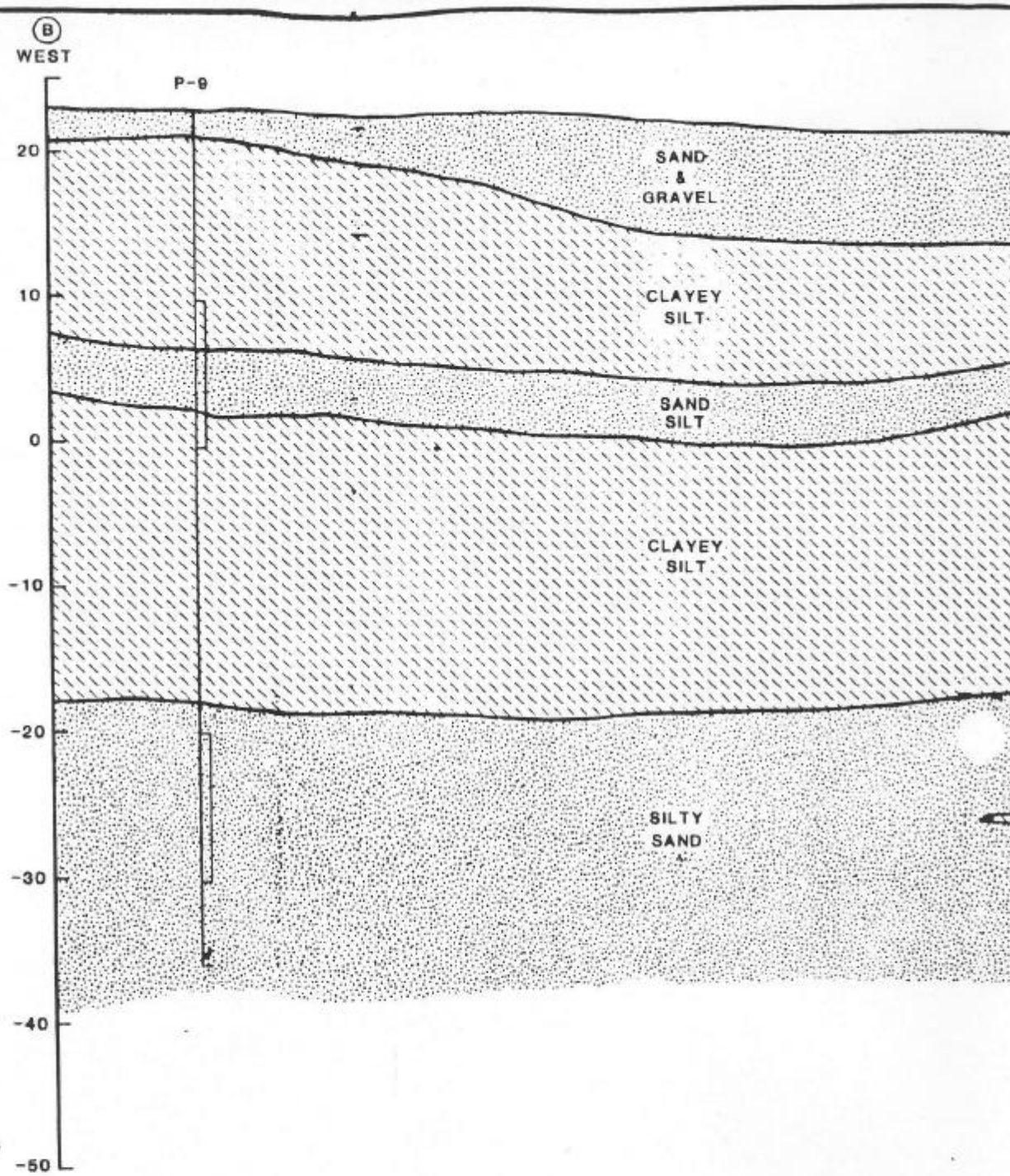
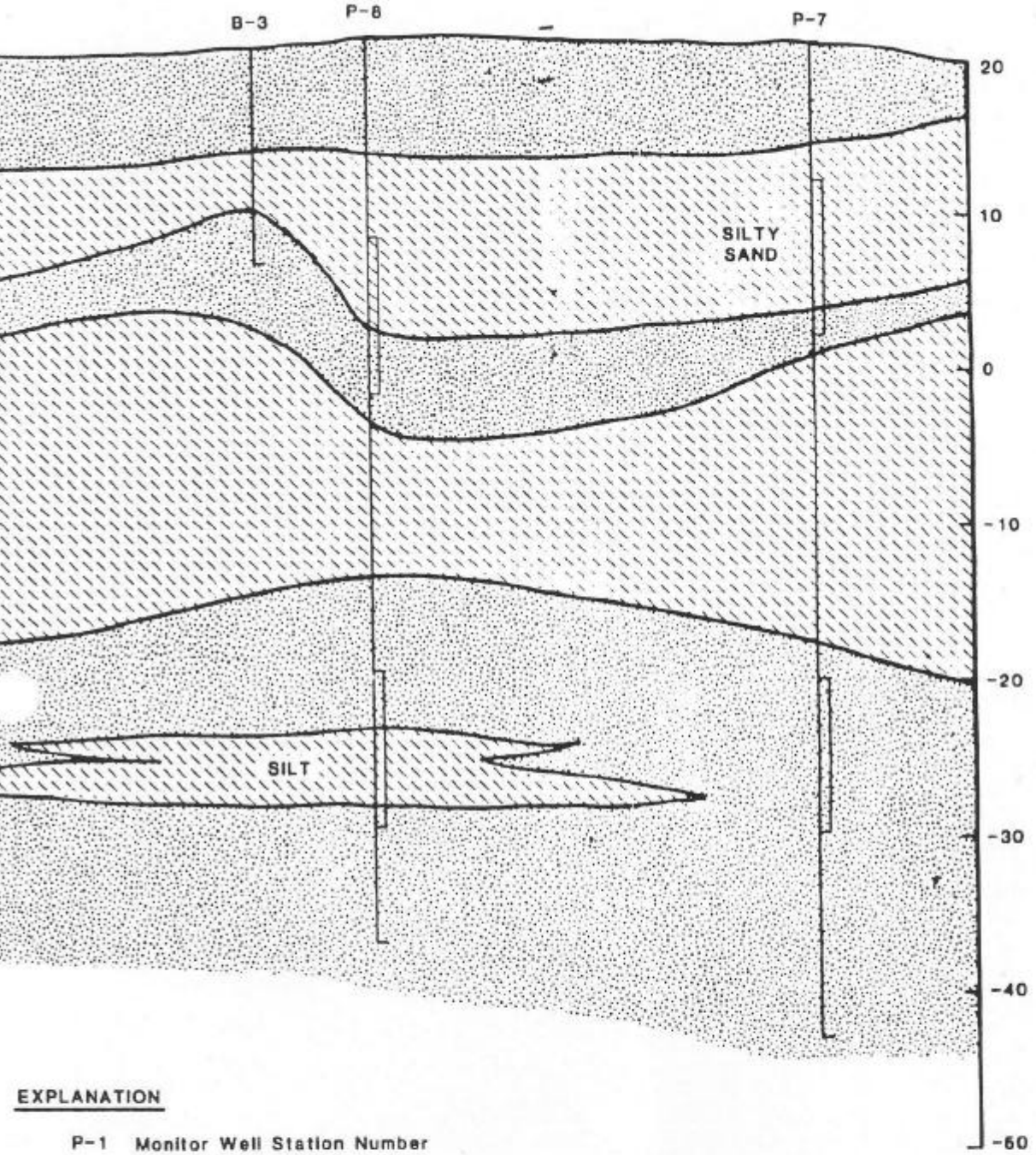
HOUSTON, TEXAS

PENNWALT CORP.
Tacoma, Wash.

FIGURE 4.6
HYDROGEOLOGIC
PROFILE A - A'


B
WEST
P-9
20
10
0
-10
-20
-30
-40
-50
ELEVATION (MSL)
SAND & GRAVEL
CLAYEY SILT
SAND SILT
CLAYEY SILT
SILTY SAND
0
200
400
600
Horizontal Scale in Feet
Vertical Exaggeration-20

ELF000180




EXPLANATION

P-1 Monitor Well Station Number

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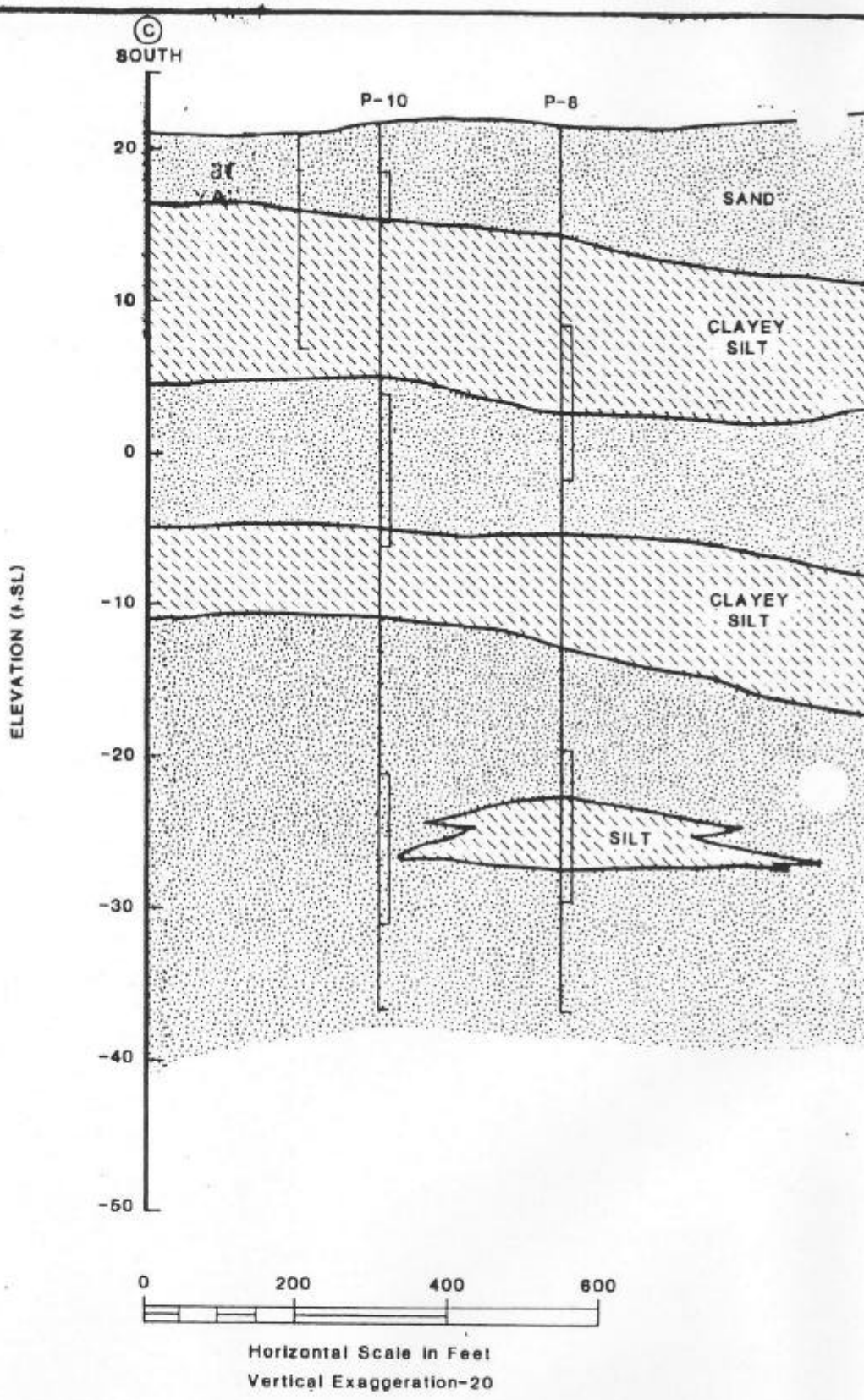
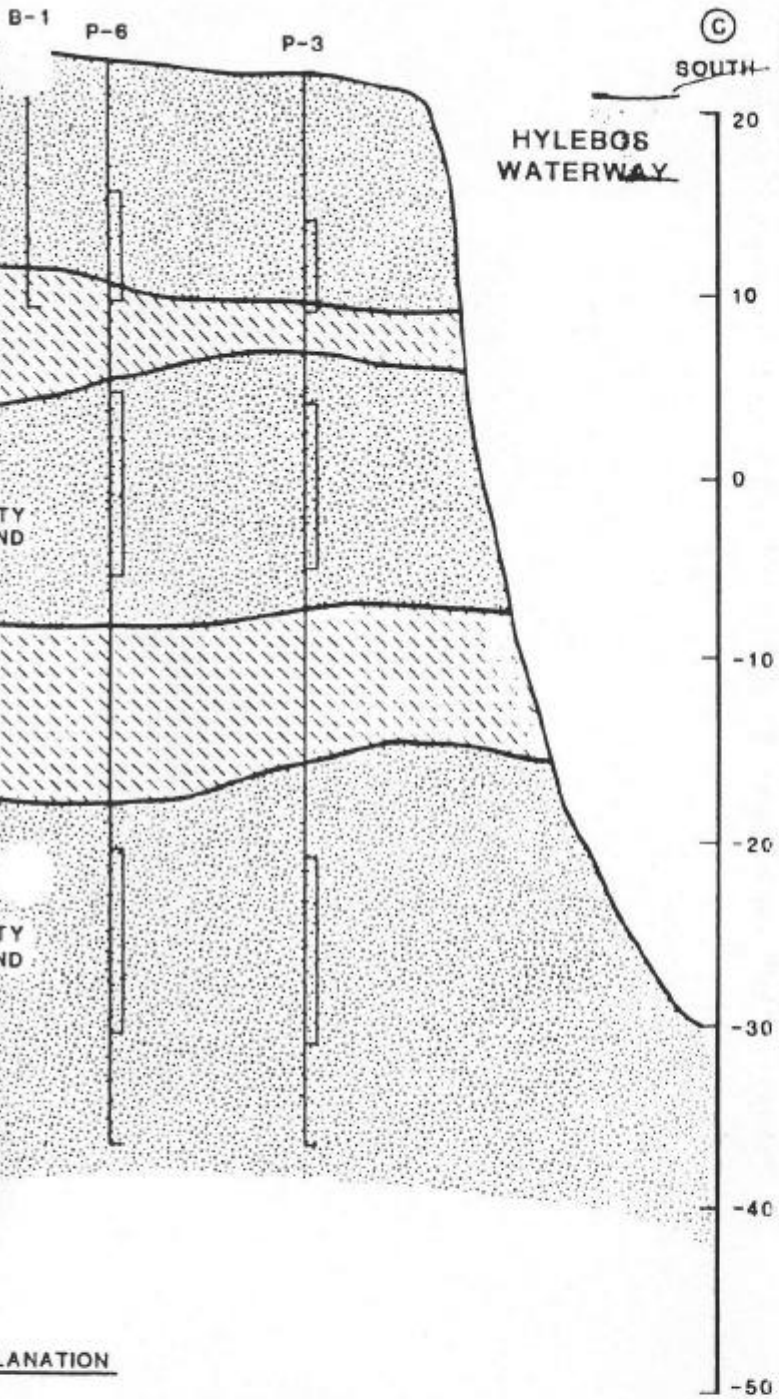
HOUSTON, TEXAS

PENNWALT CORP.
Tacoma, Wash.

FIGURE 4.8
HYDROGEOLOGIC
PROFILE B - B'


C
SOUTH
P-10
P-8
20
10
0
-10
-20
-30
-40
-50
SAND
CLAYEY SILT
CLAYEY SILT
SILT
ELEVATION (ft.SL)
0
200
400
600
Horizontal Scale in Feet
Vertical Exaggeration-20

ELF000181




LANATION

P-1 Monitor Well Station Number

Screen Interval

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NASHVILLE, TENNESSEE
HOUSTON, TEXAS

PENNWALT CORP.
Tacoma, WASH.

FIGURE 4.7
HYDROGEOLOGIC
PROFILE C - C'